BIBLIOGRAPHY OF INVESTMENT AND OPERATING COSTS FOR CHEMICAL AND PETROLEUM PLANTS

SUPPLEMENT 2 (JULY 1952 - JUNE 1954)

BY E. E. HARTON, JR.

* * * * * * * * * **Information Circular 7751**

MARCH 3, 1849

UNITED STATES DEPARTMENT OF THE INTERIOR
Fred A. Seaton, Secretary
U.S.
BUREAU OF MINES
Marling J. Ankeny, Director

Work on manuscript completed October 1955. The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is made: "Reprinted from Bureau of Mines Information Circular 7751."

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BIBLIOGRAPHY OF INVESTMENT AND OPERATING COSTS FOR CHEMICAL AND PETROLEUM PLANTS,
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by

E. E. Horton, Jr.[1]

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Information Circular 7751

INTRODUCTION

Bureau of Mines Information Circular 7516, Bibliography of Investment and Operating Costs for Chemical and Petroleum Plants, was published in October 1949 to aid in estimating investment and operating costs of processes for manufacturing synthetic liquid fuels. Development of such processes by the Bureau of Mines was authorized by Public Law 290, 78th Congress. This bibliography included references to and abstracts of publications appearing from 1930 to September 1948 on all processes in general use in the petroleum refining and chemical industries.

Bureau of Mines Information Circular 7705, Supplemental Bibliography on Investment and Operating Costs for Chemical and Petroleum Plants, was prepared to cover the area from September 1948 through June 1952.

Publications in this field have been quite numerous since Information Circular 7705 was compiled. This latest report covers the period from July 1952 through June 1954.[2]

The information in this paper was obtained from the following sources:

1. Bureau of Mines Information Circulars.
2. Bureau of Mines Reports of Investigations.
3. Chemical and Engineering News.
4. Chemical Engineering.
5. Chemical Engineering Costs Quarterly.
6. Chemical Engineering Progress.
7. Chemical Week.
8. Industrial and Engineering Chemistry.
9. Mines Magazine, The Colorado School of Mines.
10. Oil and Gas Journal, The.
11. Petroleum Engineer.
12. Petroleum Processing.
13. Petroleum Refiner.
14. World Oil.

No attempt was made to include every news item. This type of information appeared in several of the publications under such headings as Business & Industry, Companies in the News, Headlines of the Month, Industrial News, Industry, Refining and Gas Processing News, Refining News, What's Happening, Who's Building, and others.

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[2] Only articles containing domestic cost information have been included in this bibliography.

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ACKNOWLEDGMENTS

This report was prepared as a part of the Synthetic Liquid Fuels Program of the Bureau of Mines at the Petroleum and Oil-Shale Experiment Station, Laramie, Wyo., under the general direction of H. P. Rue and H. M. Thorne, and the immediate supervision of W. I. R. Murphy and S. S. Tihen.

The work was done under a cooperative agreement between the University of Wyoming and the United States Department of the Interior, Bureau of Mines.

ABSTRACTS

1. ABBOTT, W. E. Power Reactor Design Fundamentals. Chem. Eng. Prog., vol. 50, No. 5, May 1954, pp. 245-248.

   Discusses utilization of "spare" neutrons from fission reactions to produce electrical power. Works out in detail the costs of producing 6-mils-per-kw.-hr. electric power and at the same time discusses process design and reactions.

2. ADAMS, N. R., and PRICE, W. J. Economic Evaluation of Vacuum Flashing, Delayed Coking, and Solvent Decarbonizing. Oil Gas Jour., vol. 51, No. 46, Mar. 23, 1953, pp. 300-302.

   The title describes the contents very well. Considers these processes with respect to catalytic cracking feed stock preparation and brings up to date similar information that appeared in a previous paper.[3]

3. _____. If You Build a 40,000 b/d Refinery, Combination Processing Can Cut 22% Off Investment Costs. Petrol. Proc., vol. 8, No. 10, October 1953, pp. 1505-1510.

   Describes combination processing as an integrated refinery with continuous flow and little intermediate storage, not as a refinery composed of a group of individual processing units. Compares the two types of refineries at 10-, 20-, and 40-thousand-barrel-per-day capacities in detail with respect to investment and operating costs, personnel requirements, and production economics, both for the gulf coast and east coast. Substantiates claims of considerably lower costs for the combination refineries over the conglomerate type and offers explanation for the delay in accepting the former.

4. AHLNESS, R. L. Schedule Your Maintenance for Minimum Cost. Chem. Eng., vol. 60, No. 5, May 1953, pp. 236-237.

   Describes "how the process engineer can determine the most economic cycle for process equipment which shows a decline in performance as a function of time." Presents two hypothetical examples to illustrate the procedure advocated. Curves show production costs. Mentions other costs in general terms.

5. ALBERTS, L. W., BARDIN, J. S., BEERY, D. W., JONES, H. R., and VIDT, E. J. Production of Methane From Coal; An Economic Study. Chem. Eng. Prog., vol. 48, No. 10, October 1952, pp. 486-493.

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[3] Dickinson, J. T., and Adams, N. R. Lubricant Stocks Improved by Propane Deasphalting. Oil Gas Jour., vol. 44, No. 47, Mar. 30, 1946, pp. 185, 189-190, 193-194, 197, 200.

This is an economic study of methane production from coal. Contains numerous tables of data and related explanations for unit construction costs, investment breakdown of plant equipment, plant equipment depreciation, fuel and utilities costs, and production costs for various processing steps.

6. **ANDERSON, C. R.** Readers' Views and Comments: Energy Economics. Chem. Eng., vol. 59, No. 11, November 1952, p. 258.

Letter from C. R. Anderson to the editor commenting on the recent book of reprints, Data and Methods for Cost Estimation, and inquiring if the subject of electric power has been or will be covered. The editor stated that the February and March 1953 issues would have articles on the subject.

7. **ANDREA, K. S.** Conoco Leaves Boilers Outdoors at Billings.... Learns That Unhoused Boiler Installations are Cheaper, Safer........ Oil Gas Jour., vol. 52, No. 35, Jan. 4, 1954, pp. 66-67.

Discusses advantages of unhoused boiler installations. Cost of housed boilers stated to add $25,000 to the investment cost for the most inexpensive type of material. Gives costs only in general terms.

8. **BADGER, W. L., and STANDIFORD, F. C.** Anhydrous NaOH: Today's Technology. Chem. Eng., vol. 61, No. 2, February 1954, pp. 183-187.

This is a progress report that tells how and why "continuous finishing of caustic in Dowtherm-heated evaporators is superseding batch finishing in direct-fired pots." Advantages claimed for the new process are: Installation costs only one-fifth as much as for new pot installation of same capacity; fuel costs halved; maintenance expense lower - nickel tube replacements less than half the cost of pot replacements; and various companies have saved from $2 per ton of finished caustic to many times that figure.

9. **BALL, DOUGLAS.** Underground Oil Storage........ Petrol. Eng., vol. 24, No. 13, December 1952, pp. A-49-A-50, 55-56, 58.

Discusses the Edholm method of underground fuel-oil storage. Gives Swedish cost comparison for above and below ground storage, but also quotes an N.P.C. figure of $2 to $8 per barrel in impermeable formations.

10. _____. Underground Storage.... It's Here to Stay. Oil Gas Jour., vol. 52, No. 12, July 27, 1953, pp. 316, 318, 320-322.

Gives several reasons why underground storage is desirable and economical and includes brief cost figures. Information similar to, but not the same as, ref. 9.

11. **BARDIN, J. S., and BEERY, D. W.** Producing Ammonia Synthesis Gas........ Petrol. Refiner, vol. 32, No. 2, February 1953, pp. 99-102.

Discusses the low-temperature nitrogen-washing process. States that a nitrogen wash plant to produce 98 percent hydrogen - 2 percent nitrogen in a quantity equivalent to 200 tons per day of ammonia (35.3 tons per day of hydrogen) would cost $965,000. This figure compares with $1 million for a plant to produce 200 tons of ammonia per day from a gas consisting of 96 percent hydrogen, 3 percent carbon monoxide, and 1 percent methane.

12. BARNES, K. B. Boom in Ammonia........ Oil Gas Jour., vol. 51, No. 41, Feb. 16, 1953, pp. 95-97.

Summarizes United States plant construction of ammonia-producing facilities. Lists plant locations, investment costs, and capacities. Includes description of ammonia, nitric acid, ammonium nitrate, and "Spensol" plants of Spencer Chemical at Vicksburg, Miss.

13. BARRY, C. B. Small Investment, Portability, Adaptability.... Three Reasons Why Portable Gasoline Plants Gain in Popularity........ Oil Gas Jour., vol. 51, No. 25, Oct. 27, 1952, pp. 96-98, 106.

Discusses trends toward use of portable units, their capabilities, and factors that influence selection of a process. Gives investment costs in general terms. Shows $7,000 per year operating expenses for a plant making 3,000 gallons per day. Indirect costs on installation are $6,000 to $8,000.

14. BAUMANN, G. P., and SMITH, M. R. Extract Isobutylene with H_2SO_4........ Petrol. Refiner, vol. 33, No. 5, May 1954, pp. 156-159.

Describes Standard Oil Development's combination extraction-regeneration process for producing an isobutylene stream of 96 percent purity. Two million dollar investment for plant producing 80 short tons of isobutylene from 6,300 barrels of feed per day.

15. BEATTIE, R. D., and VIVIAN, J. E. When Making Cost Estimates Watch Your Language. Chem. Eng., vol. 60, No. 1, January 1953, pp. 172-175.

Defines and relates the various terms used by engineers in economic analyses. Includes example forms for: Estimated income statement, estimated manufacturing cost of sales, and estimated capital cost statement.

16. BECKWITH, R. L. Application of Automatic Gaging and Controlling Equipment to Oil Field Production Operations. Petrol. Eng., vol. 25, No. 8, Reference Annual 1953, pp. B-7-10, 12, 14, 16, 18.

Contains costs for selective switches, piping, activated valves, liquid-level indicators, recorders, and panel board.

17. _____. 25 Ways to Automatically Gage and Control Oil-Field Producing Operations. Oil Gas Jour., vol. 52, No. 11, July 20, 1953, pp. 90-99.

Contains essentially the same information as ref. 16.

18. BELL, J. E. Economics of Spares in Refineries........ Petrol. Eng., vol. 25, No. 12, November 1953, pp. C-54, 57.

The author attempts to answer the questions, "when is it proper to install a spare pump or compressor?" and "if a spare is needed, how many should be installed?" Presents a curve for estimating the optimum number of units for minimum capital investment. This curve is derived from an equation based on Nelson's six-tenths factor. An example illustrates application of the curve.

19. _____. What Price Spares in a Refinery? Oil Gas Jour., vol. 51, No. 46, Mar. 23, 1953, pp. 244, 247-248.

Contains essentially the same information as ref.18.

20. BELL, J. S., and DEVEAUX, D. R. Why Prestressed Concrete in Refinery?........ Oil Gas Jour., vol. 52, No. 30, Nov. 30, 1953, pp. 78, 87-90.

"Underlines the basic principles of prestressed concrete, advantages and disadvantages and importance to the industry." Includes brief cost comparison for steel and concrete tanks.

21. BENEDICT, MANSON. Chemical Engineering Aspects of Nuclear Power. Ind. Eng. Chem., vol. 45, No. 11, November 1953, pp. 2372-2380.

"This paper is concerned with the principal fuel cycles which have been considered for nuclear power plants and the chemical processes that are needed to make these fuel cycles feasible and economical. The processes discussed come under the headings of:

1. Isotope separation.
2. Extraction of uranium and thorium from their ores.
3. Purification of uranium and thorium.
4. Separation of reactor products."

Natural uranium may cost $35 per pound or 7.7 cents per gram. Under these conditions fuel cost for electric power in the once through flow plan given is 2.5-mils-per-kw.-hr. In a fast breeder contribution of raw fuel to power costs is only 0.01-mil-per-kw.-hr. With heavy water cost at $82 per pound and with an inventory of 250 tons required for a 211.5 kw. power plant, heavy water cost is $41,000,000 or $200 per kilowatt of generating capacity.

22. _____. What Is Delaying Industrial Nuclear Power? Chem. Eng. News, vol. 31, No. 10, Mar. 9, 1953, pp. 986-990.

Analyzes the subject and includes some cost information on electrical power production from nuclear energy.

23. BERGMAN, D. J. How to Instrument a Fluid Cat Cracking Unit........ Petrol. Refiner, vol. 32, No. 4, April 1953, pp. 185-188.

Presents successful remedies for long-standing problems on the subject. Instrumentation cost approximately $70,000, or about 5.5 percent of plant cost for a unit whose original capacity was 4,000 barrels per day but which has run at 8,000 barrels per day after changes were made.

24. BESCHER, R. H. Treating Cooling-Tower Lumber to Reduce Fungal Decay. Oil Gas Jour., vol. 52, No. 36, Jan. 11, 1954, pp. 82-83.

Discusses causes of wood failure and includes a tabular cost comparison of pressure-creosoted and untreated redwood cooling towers.

25. BEYCHOK, M. R. Build a Flare for Under $5,000. Petrol. Proc., vol. 8, No. 8, August 1953, pp. 1162-1163.

Describes a "ground" or horizontal type flare with 2 million std. cu. ft. per day capacity. Cost under $5,000.

26. BILLUE, G. H. Underground Storage of Hydrocarbons........ Petrol. Eng., vol. 24, No. 13, December 1952, p. A-73.

Discusses briefly recent trends toward underground storage. Gives the following costs:

Capacity, thousands of barrels	Dollars per barrel
10 - 50	2.00
50 - 100	1.50 - 1.25
100 - 500	1.00 - .50
500 - 1,000	.50 - .25

Gives $5 to $8 per barrel of capacity for liners for limestone and sandstone formations to store liquefied petroleum gas and anhydrous ammonia.

27. _____. Underground Storage of Hydrocarbons Today........ Petrol. Refiner, vol. 32, No. 4, April 1953, pp. 136-138.

Discusses the how, when, and where of underground storage development and gives reasons for rapid increase in the use of this type of storage. Gives cost of 50 cents to $1 per barrel of capacity as cost of underground storage in the West Texas-Oklahoma-Kansas area.

28. BIRMINGHAM, W. J. Ultraforming........ Petrol. Eng., vol. 26, No. 4, April 1954, pp. C-35-37.

Describes the new low-pressure, fixed-bed platinum catalytic reforming process of Stanolind. Catalyst cost, including platinum recovery, is $4 per pound or less than 4 cents per barrel of feed.

29. BIXLER, G. H., and COBERLY, C. W. Wulff Process Acetylene. Ind. Eng. Chem., vol. 45, No. 12, December 1953, pp. 2596-2606.

Discusses history of acetylene development here and abroad and includes considerable processing and economic data based on operations of the Wulff Process Co. plant.

30. BLAND, W. F. New Urea Synthesis Process........ Petrol. Proc., vol. 7, No. 10, October 1952, pp. 1457-1460.

Discusses the "Inventa" process for producing urea from liquid carbon dioxide and ammonia. Estimates $3 million and $4 million, respectively, for 100- and 150-ton-per-day plants.

31. _____. Your Process May Be Better - But It May Lose on Taxes. Petrol. Proc., vol. 8, No. 10, October 1953, p. 1443.

This is an abstract of a paper "Consideration of Capital Costs for a Petrochemical Project" presented by E. B. Chiswell and J. J. Merrill at AICE meeting in San Francisco, Calif., Sept. 13-16, 1953.

Discusses the detrimental effect taxes can have on progress in development of new processes and products. An example compares costs of ethylene oxide preparation by the direct oxidation and chlorohydration processes. Corresponds to ref. 176.

32. **BOBERG, I. E., and FICKETT, W. R.** Alternate Types of Vessel Construction - A Cost Comparison. Oil Gas Jour., vol. 52, No. 13, Aug. 3, 1953, p. 107.

"The occurrence of serious graphitization is not always predictable in advance. In order to shed some light on the subject of first cost, it was suggested that it would be helpful to develop comparative cost information on several available alternatives. The alternate types of construction were selected by the API Committee in charge of the program, and the sole purpose of this paper is to evaluate them."

This is the introduction to refs. 34 and 35, and the three combined contain essentially the same information as either ref. 33 or 36.

33. _____. A Cost Comparison, Alternate Types of Vessel Construction........ Petrol. Eng., vol. 25, No. 11, October 1953, pp. C-21, 24, 26, 28.

Contains essentially the same information as ref. 36 and combined refs. 32, 34, and 35.

34. _____. Cost Comparison - Field-Erected Vessels. Oil Gas Jour., vol. 52, No. 15, Aug. 17, 1953, p. 161.

Evaluates first cost, as it applies to plate construction, of ASTM A-285, A-201, and a graphitization-resistant A-301 steel. A reactor was chosen for comparison.

This combined with refs. 32 and 35 contains essentially the same information as ref. 33 or 36.

35. _____. Cost Comparison - Shop-Built Vessel. Oil Gas Jour., vol. 52, No. 16, Aug. 24, 1953, p. 145.

Contains vessel and insulation costs for shop-built vessel construction of ASTM A-285, A-201, and A-301 steel, as well as a discussion of welding problems.

This combined with refs. 32 and 34 contains essentially the same information as ref. 33 or 36.

36. _____. Deterioration of Metals, Relative Costs of Alternative Types of Reactor Vessel Construction. Petrol. Proc., vol. 8, No. 5, May 1953, pp. 690-692.

Contains essentially the same information as ref. 33 or combined refs. 32, 34, and 35.

37. **BOGART, M. J. P., SCHILLER, G. R., and COBERLY, C. J.** The Wulff Process for Acetylene From Hydrocarbons. Petrol. Proc., vol. 8, No. 3, March 1953, pp. 377-382.

Discusses in detail the Wulff acetylene process. Includes extensive operating and economic data.

38. **BOHNLOFINK, J. J.** Pro & Con: Another Cost Challenge. Chem. Eng., vol. 60, No. 4, April 1953, p. 164.

Letter from J. J. Bohnlofink to the editor commending the series of cost articles that appeared in the January 1953 issue of Chemical Engineering (refs. 15, 50, 76, 325, 390, 450, 533, 552, and 590) and suggesting that writers correlate their costs with the ENR or Marshall and Stevens indexes.

39. **BOND, W. W.** Preparing Preliminary Job Estimates........ Oil Gas Jour., vol. 52, No. 32, Dec. 14, 1953, pp. 106-107, 127, 129.

Presents a series of charts designed to enable quick and inexpensive cost estimates for those concerned with manufacturing and research management. Accuracy is 10 - 20 percent. Two methods considered: 1. Pricing for total costs; and 2. pricing for differences between alternatives.

See ref. 397 for errata.

40. **BOONE, M. G., and FERGUSON, D. F.** Visbreaking.... Still the Basic Process for Fuel Reduction........ Oil Gas Jour., vol. 52, No. 46, Mar. 22, 1954, pp. 166, 168, 211, 213.

Describes process innovations developed by Eastern States Petroleum Co. and includes some cost information.

41. **BORN, H. J., and ROSE, G. E.** Higher Thermal Efficiencies With Solid Fuel Savings, Plus Reduction in Number of Costly Shutdowns, Boost Use of Direct-Fired Heaters in Natural-Gasoline Plants. Oil Gas Jour., vol. 51, No. 44, Mar. 9, 1953, pp. 101-104.

Discusses three types of radiant-convection heaters. Only cost is statement that thermal efficiencies range up to 89 percent and annual savings range up to $22,000.

42. **BOTTOMLEY, HAROLD.** Definitive Cost Estimating........ Petrol. Refiner, vol. 32, No. 10, October 1953, pp. 110-112.

Discusses detailed and rough cost estimates and stresses the importance of using a set procedure for assembling a detailed estimate. Gives a sample of a materials check list, discusses each item on the check list, and illustrates the use of the check list by showing the average percentage of total materials attributable to each item for five fluid catalytic cracking units costing from $1,300,000 to $1,800,000.

43. _____. How to Prepare Cost Estimates........ Petrol. Refiner, vol. 32, No. 9, September 1953, pp. 211-214.

Gives tips on preparing cost estimates of piping, insulation, electrical equipment, structures, foundations, buildings, contractors expense, and profits. Includes several examples of estimating forms.

44. **BOWERS, W. S.** Trend is Toward More Automatic Process Control for Improved Products, Lower Operating Costs. Petrol. Eng., vol. 26, No. 4, April 1954, pp. C-53-54, 56-58, 60-62.

Discusses the following factors that influence refinery process instrumentation: 1. Basic concepts of automatic control; 2. new developments in air-operated instrumentation; 3. new electronic control systems; 4. the newest methods of presenting information to the operator with miniature recorders and graphic panels; 5. automatic control techniques from product composition; and 6. trends toward automatic computer control. Uses control of vacuum tower product streams to desired viscosity specifications to illustrate "some typical production economies that can be realized from better automatic control."

45. **BOWLES, V. O.** Uniflux. Chem. Eng., vol. 61, No. 5, May 1954, pp. 174-175.

Describes design and operation of Socony-Vacuum's new fractionating tray. Costs $1.00 per square foot of superficial tower area per tray.

46. _____. Uniflux Fractionating Tray. Petrol. Eng., vol. 26, No. 5, May 1954, pp. C-11-13.

Contains essentially the same information as refs. 45 and 47.

47. _____. Where Are We Headed on Fractionating - Absorption Tray Design?........ 6. Socony Uniflux........ Oil Gas Jour., vol. 52, No. 51, Apr. 26, 1954, pp. 176, 179-180.

Contains essentially the same information as refs. 45 and 46.

48. **BOYD, J. H.** Pro & Con: Estimate in a Hurry. Chem. Eng., vol. 60, No. 4, April 1953, pp. 159-160.

Letter from J. H. Boyd to the editor commenting on the article, How to Estimate Costs in a Hurry, by H. E. Wessel (ref. 590).

49. **BOYD, LAYTON.** Design and Operation of Dehydrators for Volatile Hydrocarbons. Oil Gas Jour., vol. 51, No. 31, Dec. 8, 1952, pp. 106-107.

Discusses closed-system operation with solid desiccant and shows additional profits possible with this type unit.

50. **BRACA, R. M., and HAPPEL, J.** New Cost Data Bring Economic Pipe Sizing Up To Date. Chem. Eng., vol. 60, No. 1, January 1953, pp. 180-187.

Presents extensive efficiency and economic data on pumps, piping, valves, and insulation, so that the economic liquid velocity and pipe size for any process plant installation can be selected. Illustrates method with examples.

51. **BRACE, R. M., and MERIMS, R.** Selecting Materials and Designing Equipment for High-Temperature Service. Chem. Eng., vol. 60, No. 2, February 1953, pp. 165-171, 328, 330-332, 334-336.

Presents results of a comprehensive survey made by a leading design firm for its own guidance in selecting materials and designing equipment for high-temperature service. Includes physical design and cost data.

52. **BRADBURY, W. A.** Monolithic Linings for Refinery Service........ Petrol. Refiner, vol. 33, No. 3, March 1954, pp. 167-172.

Discusses results of actual plant use of monolithic linings in vessels and lines handling catalysts and hydrocarbons. Lists the approximate costs per square foot for insulating liners and for liner wear.

53. **BRADLEY, K. J., and KRONOWITT, PHILLIP.** Anthraquinone Vat Dyes. Ind. Eng. Chem., vol. 46, No. 6, June 1954, pp. 1146-1156.

A staff-industry collaborative report. Includes brief history of anthraquinone vat dye development, production and sales figures, and a detailed description of the Toms River, N. J., plant of Ciba States, Ltd. Investment of $18,000,000 for plant with a yearly capacity of 4 million pounds of paste dyestuff.

54. **BRESTON, J. N.** Gas Injection in Water-Flooding Operations........ Oil Gas Jour., vol. 51, No. 28, Nov. 17, 1952, pp. 400, 403, 407-410.

Reports "results of a survey of the activities in gas injection before and during water flooding in Bradford and Allegany fields". Includes such cost figures as compressor depreciation, labor, supervision, and fuel.

55. **BRIEN, E. B.** First Complete New England Refinery........ Petrol. Eng., vol. 26, No. 1, January 1954, pp. C-41-42.

Briefly discusses this first complete New England refinery and its operation. Gives $240 per ton as fluid catalytic cracker catalyst cost.

56. _____. First East Coast Catformer on Stream. Petrol. Eng., vol. 26, No. 5, May 1954, p. C-67.

Briefly describes the new catformer unit at Atlantic Refining's Point Breeze, Pa., refinery. Gives $250,000 as cost of 40,000 pounds of catalyst containing 2,680 ounces of platinum. Also mentions the following costs for units slated for completion as part of the company's expansion program:

Installation	Daily capacity	Investment, millions of dollars
Synthetic ammonia plant	100 tons	5.5
Catalytic cracking unit	35,000 barrels	12.5
Pipe still with atm. and vac. towers ..	50,000 barrels	9.5
Aviation alkylate unit	3,500 barrels	4.5
Waste-disposal plant	10 million gallons	4.5

57. _____. First Eastern Aromatics Plant at Marcus Hook. Petrol. Eng., vol. 26, No. 5, May 1954, pp. C-33-36.

Describes the new Houdriforming-Udex aromatics plant at Marcus Hook, Pa. Gives $15,000,000 investment and yearly capacity for the plant as 19 million gallons each of benzene and toluene and 15 million gallons of xylenes.

58. _____. Low Cost, Waste Water Cleaner........ Petrol. Eng., vol. 26, No. 6, June 1953, pp. C-25, 27, 29.

Discusses the dissolved air-flotation process for flocculating and removing foreign matter from waste water. Gives investment cost of approximately $27,000 for a unit capable of handling 1 million gallons of waste water daily. Gives the following additional costs:

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	Cents per M gallons
Chemical cost	1.0
Chemical cost plus additional treatment[4] ...	1.5
Cooling water treatment	2.0
Drum washer water	3.0

59. BRIEN, E. B. Oxidizing Catalyst at Peak Performance........ Petrol. Eng., vol. 25, No. 9, August 1953, pp. C-15-16.

Discusses "oxycat", an alumina-platnium oxidation catalytic unit, used to combust flue gases for subsequent recovery of heat of combustion. Ref. 560 includes essentially the same information.

60. ____. Switch Lamps Converted to Electric Operation. Petrol. Eng., vol. 25, No. 10, September 1953, p. C-25.

Gives estimated savings possible by converting oil lamps to the battery type.

61. **BROOKS, B. T.** Development of Petroleum and Petrochemical Processing. Part I - Renaissance of Petroleum Processing. Petrol. Eng., vol. 26, No. 1, January 1954, pp. C-25-26, 28-29; Part 2 - Research Foundations of Modern Petroleum Processing and Chemical Manufacture. Petrol. Eng., vol. 26, No. 2, February 1954, pp. C-5-10, 12; Part 3 - Competitive Raw Materials and Processes for Petrochemicals........ Petrol. Eng., vol. 26, No. 3, March 1954, pp. C-9-12, 14-16, 18.

Part 1 contains no cost information. Part 2 discusses significant contributors to and research developments related to petroleum and petrochemical manufacture. Includes cost of natural gas and cost for producing isopropyl alcohol from propylene via the sulfuric acid route. Part 3 gives a brief discussion of manufacture of a number of petrochemicals and compares present costs for wet and dry natural gas with those for a few years ago as well as with those for coal and fuel oil. Estimates savings from $18 to $20 per ton of synthetic ammonia produced, if reforming byproduct hydrogen is available instead of having to purchase natural gas at 16.5 cents per 1,000 cubic feet. Estimates acetylene production cost at 6 cents per pound from natural gas costing 16 cents per 1,000 cubic feet. Ethylene costs vary from 3.0 to 6.5 cents per pound.

62. **BROWN, C. O.** Equipment and Design........ Part 1 - Ind. Eng. Chem., vol. 44, No. 7, July 1952, pp. 59A-60A, 62A; Part 2 - Ind. Eng. Chem., vol. 44, No. 11, November 1952, pp. 85A-86A, 88A.

Part 1 discusses the selection of chemical plant motors with consideration of safety factors involved and includes some motor costs. Also discusses water-cooling towers and what safety considerations must be given to the design for a particular operation but includes no costs. Part 2 discusses the importance of proper equipment design for unusual performance requirements. Heat exchanger costs vary from $2,335 to $8,775, depending upon design and type of materials used.

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[4] If additional treatment is necessary the chemical cost is increased 0.5 cents per 1,000 gallon.

63. **BROWN, R. L., and CARMAN, E. P.** Annual Report of Research and Technologic Work on Coal, Fiscal Year 1951. Bureau of Mines Inf. Circ. 7647, 1952, 81 pp.

Includes costs on: Removing water from coal in a fluidized drying unit; modified fire-tube boilers; boiler water treating; coal hydrogenation; and operation of atmospheric versus pressure gasification for a 10,000-barrel-per-day gas synthesis plant.

64. **BRUUN, J H., and MORGAN, J. M.........** Research and Development Costs in the Chemical Industry. Chem. Eng. News, vol. 30, No. 42, Oct. 20, 1952, pp. 4365-4367.

Presents a qualitative analysis of research operations and includes tables, as follows: Summary of functions included in research costs; functions included in research costs by individual companies; and distribution of functions included in research costs.

65. **BUELL, W. H.** Don't Be Fooled by Interest Rates. Chem. Eng., vol. 61, No. 5, May 1954, pp. 183-186.

Discusses the selection and application of interest rates. Covers such subjects as: "Should You Borrow Money or Use Your Own;" "Two Ways to Apply Interest Charges to Your Project"; "Be Careful of These Common Misconceptions about Interest".

66. **BUNN, C. N., JR.** Discussion of Preceding Papers. Oil Gas Jour., vol. 51, No. 13, Aug. 4, 1952, pp. 94-95.

Discusses 4 papers, one of which is ref. 255, presented on design and operation of refinery flares. Gives $72,000 as estimated total cost to consolidate 4 separate flares into 2; cost includes all pipeline revisions. Estimates main flare cost near $4,000 plus $900 for instrumentation and $2,700 for drip tanks and seals.

67. **BUREAU OF MINES.** Synthetic Liquid Fuels. Rept. of Investigations 4865, 1952, 83 pp.

Part 1 of the 1951 Annual Report of the Secretary of the Interior. Includes comparison of the original Bureau of Mines cost estimate and the revised estimate (based on Ebasco findings[5/]) for a coal-hydrogenation plant at Rock Springs, Wyo. Gives results of engineering and economic studies for a 30,000-barrel-per-day coal-hydrogenation plant at Rock Springs, Wyo., and at western Kentucky.

68. _____. Synthetic Liquid Fuels. Rept. of Investigations 4866, 1952, 86 pp.

Part 2 of the 1951 Annual Report of the Secretary of the Interior. Includes essentially the same coal-hydrogenation costs as ref. 67. Also contains cost estimates for 250,000-barrel-per-day operations - oil-shale processing with thermal refining and oil-shale processing with mild hydrogenation. Gives mining, crushing, and conveying costs for 19,200-tons-per-day of oil shale.

69. _____. Synthetic Liquid Fuels. Rept. of Investigations 4942, 1953, 85 pp.

[5/] Ebasco Services, Inc., Coal Hydrogenation Plants: 2 Rector Street, New York, N. Y., March 1952, 180 pp.

Part 1 of the 1952 Annual Report of the Secretary of the Interior. Includes investment and operating cost estimates for 200-, 400-, and 600-ton-per-day synthetic ammonia plants using coal as the raw material. Contains a cost estimate for a 30-ton-per-day coal-hydrogenation plant. Estimates 14 cents per 1,000 cubic feet of carbon monoxide and hydrogen produced in a high-pressure coal gasifier, assuming costs of coal at $4 per ton and oxygen at 20 cents per 1,000 cubic feet. Also includes brief costs on processing gas for a synthine plant.

70. **BUREAU OF MINES.** Synthetic Liquid Fuels. Rept. of Investigations 4943, 1953, 70 pp.

Part 2 of the 1952 Annual Report of the Secretary of the Interior. Includes a summary of capital requirements for a 230,000-barrel-per-day shale-oil operation using various cracked-naphtha treating methods. Contains a nomograph for determining the product selling price for any selected values of the following: Ratio of equity to mortgage capital; rate of return after income tax; income tax rate; interest rate on mortgage capital; capital requirement; net operating cost; and rate of production.

71. **BURK, F. C., BALCK, E. S., and TEST, L. J.** Is LPG a Cheap Motor Fuel?........ Petrol. Refiner, vol. 32, No. 6, June 1953, pp. 119-121.

Gives a comparison,.in dollars and cents, between LPG, gasoline, and diesel fuel as a motor fuel, based on an actual test. Also includes an installed cost of $12,250 for a 15,000-gallon LPG storage tank.

72. **BURKE, A. J.** Down With Bagging Costs. Chem. Eng., vol. 61, No. 6, June 1954, pp. 234-236.

Discusses 4 possible ways a company may be wasting bagging dollars and suggests 5 possible ways to reduce bagging costs.

73. **BUSWELL, A. M., and ROBERTS, W. J.** Water Resources. Ind. Eng. Chem. vol. 46, No. 3, March 1954, pp. 487-493.

Discusses the water resources in the east north-central States. Gives cost of industrial water. Estimates costs of small reservoirs at $250 to $300 per acre foot, ranging down to $175 per acre foot for larger ones; investment for 30-inch pipelines at $120,000 per mile; $450,000 investment for a 5-million-gallon-per-day filter plant; and operating costs for filter plants range from $15 to $18 per million gallons.

74. **BUTCHER, I. A.** Pro & Con: Sour Cost Estimates. Chem. Eng., vol. 60, No. 11, November 1953, pp. 170-171.

Letter from I. A. Butcher to the editor commenting in Chaplin Tyler's article, "Where Cost Estimates Go Sour" (ref. 552).

75. **CALLAHAM, J. R.** Memo From the Editor: New Data on the Cost of Fans and Blowers. Chem. Eng., vol. 59, No. 9, September 1952, p. 119.

Presents a graph, costs of cast iron positive rotary compressors versus capacity, as a sample of the information R. E. Denzler will include in his article (ref. 193) to appear in the October 1952 issue of Chemical Engineering.

76. CALLAHAM, J. R. Why the Emphasis Today on Costs? Chem. Eng., vol. 60, No. 1, January 1953, p. 157.

Introduces a series of cost articles (refs. 15, 50, 325, 390, 450, 533, 552, and 590) comprising the entire feature section of this issue of Chemical Engineering.

77. CAMPBELL, J. M. Design and Choice of Equipment for Gas Dehydration. Chem. Eng. Prog., vol. 48, No. 9, September 1952, pp. 440-448.

Presents a detailed discussion of gas-dehydration equipment and processing. Includes the following operating costs for various types of dehydration systems:

	Dollars per million cubic feet
Triethylene glycol absorption	0.20-0.40
Dry desiccant	.60-1.20
Glycol injection	.60-1.30
Low temperature[6]	

Contains information similar to, but not identical with, combined ref. 78 (1 through 5) or ref. 79.

78. CAMPBELL, J. M., and LAURENCE, L. L. Dehydration of Natural Gas and Light Hydrocarbon Liquids. Part 1. Principles of Dehydration. Petrol. Refiner, vol. 31, No. 8, August 1952, pp. 65-70; Part 2.[7] Dry Desiccant Systems........ Petrol. Refiner, vol. 31, No. 10, October 1952, pp. 106-112; Part 3. Liquid Desiccant Plants........ Petrol. Refiner, vol. 31, No. 11, November 1952, pp. 109-116; Part 4. How Low Temperature Separation Can Do the Trick. Petrol. Refiner, vol. 32, No. 1, January 1953, pp. 138-142; Part 5. Taking Advantage of Hydrate Inhibitors With Expansion Refrigeration. Petrol. Refiner, vol. 32, No. 2, February 1953, pp. 131-134.

Part 1 contains no cost information. Part 2 discusses dry desiccants and their applications. Includes a brief summary of related economic factors. States that operating costs vary from $0.60 to $1.20 per million cubic feet of gas processed. One graph is entitled, "Effect of Gas Pressure on Dry Desiccant Dehydrator Costs", and another is entitled, "Initial Cost of Dry Desiccant Dehydrators as a Function of Gas Flow Rate (1,000 p.s.i. W.P.)". Part 3 discusses advantages and disadvantages of various desiccants and lists cost factors and operating variables to be considered. States that an investment figure of $500 per million cubic feet is safe for plants with more than 50 million cubic feet capacity and estimates the operating costs for triethylene glycol plants range from 20 to 60 cents (average 40 cents) per million cubic feet of gas handled. Part 4 presents a detailed description of low-temperature separation and includes a series of curves (2,000, 3,000, 4,000, and 6,000 p.s.i.g. knockout pressure and separator pressure of 1,050 p.s.i.g.) that show approximate initial costs per million cubic feet of capacity. Gives operating cost range from 20 to 60 cents per million cubic feet of gas handled. Part 5 discusses the use of hydrate inhibitors in conjunction with expansion refrigeration. Compares methanol and diethylene glycol solutions as hydrate inhibitors as to cost per gallon, cost of regeneration, and net cost per million cubic feet of gas handled. Compares the economics of (1) Low-temperature systems with two stage separation; (2) low-temperature systems with stabilizer; (3) glycol injection with two stage separation; and (4) glycol injection with stabilizer. Gives series of curves showing initial cost for glycol injection systems, including stabilizer, at several knockout pressures for capacities from 3 to 25 million cubic feet per day. Estimates operating costs, including utilities and materials, but not labor, from 60 to 13 cents per million cubic feet of gas handled, as capacity increases. This combined series of articles contains information similar to, but not identical with, either ref. 77 or 79.

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[6] Involves no direct operating expense other than labor and routine maintenance.
[7] Part 2 includes Skinner, Wickliffe, Jr., as an author.

79. **CAMPBELL, J. M., and MADDOX, R. N.** An Economic Study.... Processing and Recovery of Light Hydrocarbons in the Field........ Oil Gas Jour., vol. 51, No. 30, Dec. 1, 1952, pp. 122-125.

Compares conventional stage separation; low-temperature separation with and without the addition of stabilization; glycol injection plus stabilization; and mechanical refrigeration plus stabilization. Includes payout time, profits, and value of daily stable condensate stock recovery. Gives from $1,000 to $1,600 per million cubic feet of gas processed as cost of average low-temperature-separation system, less stabilizer. Presents representative costs for high-pressure stabilizer with and without external reflux; this includes packed column and bubble tray column curves for both low-temperature separation and glycol injection. Contains information similar to, but not identical with, ref. 77 or combined refs. 78 (1 through 5).

80. **CAMPBELL, O. F., and PENNELS, N. E.** Cat Cracker CO Boiler and Fluidized Bed Steam Superheater. Petrol. Eng., vol. 26, No. 6, June 1954, pp. C-34-36, 38-40, 42.

Describes the design and operation of the carbon monoxide boiler and fluid bed steam superheater of Sinclair's new fluid catalytic cracking unit at Houston, Tex. Gives no actual cost figures but states that the cost of the CO boiler and its appurtenances is no greater than a fired boiler of equivalent output.

81. **CANFIELD, T. L.** Combating Corrosion.... How to Sell Top Management on Corrosion Mitigation. Oil Gas Jour., vol. 52, No. 41, Feb. 15, 1954, pp. 141-142.

Briefly discusses selling management on corrosion control. Lists types of information the corrosion engineer can present to sell his idea. Gives excellent graphs[8] that compare costs of cathodic protection versus cost of reconditioningpipe; anticipated leak frequency compared to actual leaks when cathodic protection was applied; and cost of leak versus cost of cathodic protection.

82. **CARNEY, B. R., and MEYER, R. E.** Petrochemical Industry Looks to Liquefied Petroleum Gas........ Petrol. Refiner, vol. 32, No. 4, April 1953, pp. 123-127.

Discusses petrochemical development and increased dependency of this industry upon LPG as a raw material source. Gives the following alternate final values of some light hydrocarbons:

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[8] Good, D. B. Economic Factors Bearing on Application of Cathodic Protection: Pres. at a recent N.A.C.E. Cathodic Protection Symposium.

Use	Cents per gallon		
	C_2	C_3	C_4
As gaseous fuel:			
At 1.5 cents per therm	1.03	1.37	1.50
At 3.0 cents per therm	2.06	2.74	3.00
As LPG		4.00	[9]4.50
As special motor fuel		7.00	7.50
As conventional motor fuel			10.50

Makes general statement about relative production costs of some petrochemicals.

83. CHAPIN, E. V. New Method Successful-LPG in Volume Can Be Stored Underground. Petrol. Eng., vol. 26, No. 4, April 1954, pp. E-15, 17-18, 20.

Describes a method for sealing underground formations to make LPG storage possible. Estimates costs of underground storage at one-fifth that for above ground storage.

84. CHASE, J. C., and DEGLER, H. E. Economics of the Air-Cooled Heat Exchanger.... .... Petrol. Eng., vol. 25, No. 1, January 1953, pp. C-42-44, 47-48.

Discusses the advantages, design, applications, and economics of air-cooled exchangers. Compares air-cooled heat exchangers and water-cooling tower investment and operating costs.

85. CHEMICAL ENGINEERING. Acres of De Nora Chlorine Cells. Vol. 59, No. 8, August 1952, pp. 146-148.

Briefly discusses the Army Chemical Corp. $15 million Muscle Shoals caustic-chlorine plant, which has a chlorine production capacity of 150 tons per day.

86. _____. Air Tubes Dispatch Test Samples........ Vol. 60, No. 10, October 1953, p. 124.

Describes pneumatic tube system installed at Upjohn's Kalamazoo plant for delivering samples from processing areas to control laboratories. Gives $55,000 as the cost of 23,000 feet of 4-inch steel pipe and a 2,800-cubic-feet-per-minute, 1.5-pound-per-square-inch pressure Billmyre blower operated by a 25-hp. motor.

87. _____. Atomic Energy at the Crossroads........ Vol. 60, No. 3, March 1953, pp. 214-216.

Gives a general discussion of the present atomic energy situation and programs and possible future trends. Includes costs for various sizes of atomic power plants.

88. _____. Bacteria by the Bagful. Vol. 60, No. 4, April 1953, p. 120.

Describes packaged powdered bacteria that can be used to seed treating plants, as they exist, to make them more effective rather than adding new construction.

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[9] Current market price from Oil Gas Jour., vol. 51, No. 32, Dec. 15, 1952, p. 117.

89. **CHEMICAL ENGINEERING.** Better Solvent Extraction........ Vol. 60, No. 5, May 1953, pp. 124, 126-128.

Describes a new presolution cotton seed oil extraction process and compares it with existing processes. Includes costs for converting from the latter types to the new method.

90. _____. Conveyor Speeds Coating. Vol. 60, No. 10, October 1953, p. 134.

Describes a system for spraying airplane parts. Unit covers 4,000 square foot area, requires 12 workers, and costs over $150,000.

91. _____. Cut Operating Cost With Low-Cost Survey. Vol. 61, No. 1, January 1954, p. 242.

Describes a consulting service questionnaire costing $100 that can furnish the management engineer with the facts necessary to do his work.

92. _____. Don't Count Bubble Caps Out. Vol. 61, No. 5, May 1954, pp. 128, 130.

Contains commercial-scale performance and cost data obtained by C. F. Braun & Co. from its last 6 years experience with bubble caps.

93. _____. Equipment Cost Indexes (Marshall & Stevens).

These indexes are compiled quarterly for March, June, September, and December by Marshall and Stevens evaluation engineers of Chicago and Los Angeles, but the indexes are listed monthly and cover the following fields:

Process Industries:	Related Industries:
Cement manufacturing	Electric power equipment
Chemical	Mining, milling
Clay	Refrigerating
Glass	Steam power
Paint	
Paper	
Petroleum	
Rubber	

The monthly references follow:

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For a description of the method for obtaining the index number see: Stevens, R. W., Chem. Eng., vol. 54, No. 11, November 1947, pp. 124-126. For a listing of annual averages since 1913 see: Chem. Eng., vol. 59, No. 2, February 1952, p. 191. For continuation of the present reference indexes from January through June 1954, see ref. 256. See also refs. 347 and 348 for more Marshall & Stevens indexes.

94. CHEMICAL ENGINEERING. First Two-Time Winner. Vol. 60, No. 9, September 1953, pp. 122, 124.

Describes briefly the operation and potential of Carbide & Carbon's Institite, W. Va., coal-hydrogenation plant. Quotes $11 million investment for the plant that handles 300 tons of coal daily. Gives no actual production figures but states production of naphthalene is from 5 to 8 times, phenol is from 60 to 80 times, higher phenols (cresol) is from 100 to 200 times, and higher amines (quinoline) is 300 to 500 times as much as that obtained from byproduct coking of the same amount of coal.

95. _____. Fork Truck-Trailer Team-Up........ Vol. 60, No. 6, June 1953, p. 115.

Describes new, efficient transferring system developed for use in American Cyanamid's Warners plant at Linden, N. J.

96. _____. Free-Piston Gas Turbine........ Vol. 60, No. 7, July 1953, pp. 206-207.

Describes Cooper-Bessemer's first commercial free-piston gas turbine in the United States. Discusses design, operation, and the cost savings of this turbine over conventional types. Contains essentially the same information as ref. 406.

97. _____. Gas Engines Make Cheap Power........ Vol. 60, No. 7, July 1953, p. 118.

Summarizes operating experience with gas engines in aluminum plants, which has demonstrated costs that compare favorably with steam turbine stations.

98. _____. Green Light - Almost - for Power Reactors. Vol. 60, No. 5, May 1953, pp. 133-134.

K. P. Cohen and William Thompson, the heads of the country's first privately financed nuclear laboratory, Walter Kidde Nuclear Laboratories, Inc., of Garden City, N. Y., express their optimism for early power reactors. Includes some estimated cost figures for a 100,000 kw. plant. Also see ref. 274.

99. CHEMICAL ENGINEERING. How's Industrial Research?........ Vol. 60, No. 4, April 1953, p. 116.

Briefly summarizes the report prepared by Defense Department's Research and Development Board and the Bureau of Labor Statistics on private industry's research effort. Includes total research costs, expenditures as percent of gross sales, expenditure per research scientists and per research worker, percent of research government financed, etc.

100. _____. Industry Teams Report on A-Power. Part 1. Vol. 60, No. 7, July 1953, pp. 188-192. Part 2. Vol. 60, No. 8, August 1953, pp. 188-192.

Series summarizes recently declassified information on the four industry-team studies of atomic power potentialities. Part 1 includes estimated installed costs of gas-cooled and deuterium-cooled power reactors. Part 2 includes a comparison of characteristics of two modified Hanford-type, sodium-cooled graphite thermal reactors. Also includes design, operating, and cost data for dual-purpose reactors (water-cooled thermal reactor and sodium-cooled fast reactor) and presents economic aspects of the sodium-cooled fast reactor for power only.

101. _____. Labor........ Vol. 61, No. 3, March 1954, p. 188.

Discusses 1953-1954 employment and labor rates.

102. _____. Letters.... Cost about $1 Each. Vol. 60, No. 5, May 1953, p. 296.

Gives the breakdown of the cost of a letter as worked out by Kemper Insurance Group, Chicago:

	Dollars
Salary of person dictating letter	0.253
Typist salary	.405
Employee benefits	.015
Stationary and printing	.063
Machine cost	.042
Overhead (rent, light, heat)	.041
Stamps and mailing	.060
Miscellaneous	.124
Total	1.003

103. _____. Level Gaged by Remote Control........ Vol. 60, No. 7, July 1953, pp. 218, 220.

Discusses an improved remote control tank-gaging method and gives $7,500 as estimated cost for a system to gage 12 tanks from an office 50 miles away.

104. _____. Mass Spectrometer Moves Into Production Spot. Vol. 60, No. 6, June 1953, pp. 256, 258.

Describes a portable unit designed for monitoring control processes, for detecting leaks, and for analyzing gases. Gives cost as less than $10,000.

105. _____. New Ammonia Process Starts Up........ Vol. 61, No. 4, April 1954, p. 126.

Briefly discusses first commercial plant to make ammonia via partial oxidation of methane. Gives investment cost as $14,000,000 for a plant with the following daily production capacity:

	Tons
Anhydrous ammonia	210
Nitric acid	110
Ammonium nitrate solution	140
Ammoniating solutions	350

106. CHEMICAL ENGINEERING. New Process Puts Spotlight on Carbon Black. Vol. 60, No. 7, July 1953, pp. 120, 122-123.

Describes the Lynn carbon black process. Contains information similar to ref. 401 but a little more up-to-date than the latter.

107. _____. New Test Coke Oven. Vol. 60, No. 11, November 1953, pp. 142, 144.

Describes an experimental oven, developed by Bureau of Mines, that produces metallurgical coke of the same quality as commercial ovens. Gives cost of unit, including installation and auxiliaries, at about $22,000.

108. _____. New Vat Dyestuffs Plant........ Vol. 60, No. 9, September 1953, pp. 140, 142.

Briefly describes the Toms River, N. J., dyestuffs plant of Ciba States, Ltd. Gives investment cost of $18,000,000 for this plant that has a yearly production capacity of 4 million pounds.

109. _____. New Way to Control Costs. Vol. 59, No. 8, August 1952, p. 218.

Introduces D. E. Pierce and his method for controlling maintenance costs, raw material cost, operating labor hours, steam and water consumption, and other manufacturing cost elements. Article states that he explains that all other costs can be related to the number of kilowatt-hours of power consumed by the plant. Contains two samples of the type of information included in ref. 450, which is a detailed description of his method.

110. _____. No Dust, No Waste, No Heavy Labor........ Vol. 60, No. 6, June 1953, pp. 140-142.

Describes the Tote bin system, used by Chemical Products Works, Lamp Division of General Electric, for handling bulk materials. Gives $95,000 as investment cost for 100 bins plus 16 tilts with auxiliary conveyor, chutes, steel, wiring, and scales. Estimates yearly material savings at $100,000 and yearly direct labor cost at $16,000. Contains essentially the same cost information as ref. 140.

111. _____. Plants & Processes. Part 1. Vol. 60, No. 2, February 1953, pp. 176-206; Part 2. Vol. 61, No. 1, January 1954, pp. 169-208.

These references summarize the principal developments in plant construction and in new technology announced or commercialized during the periods indicated. Part 1 lists new plants and facilities under way in 1952 and new processes and technology, 1951-52. Part 2 lists new plants and facilities under way in 1953 and new processes and technology, 1952-53.

112. CHEMICAL ENGINEERING. Pre-Engineered Sections Become Store-Bought Buildings .... Vol. 61, No. 4, April 1954, pp. 140, 142, 144.

Discusses advantages and costs of installing prefabricated factory buildings.

113. _____. Pro & Con: New Series on Costs. Vol. 60, No. 1, January 1953, p. 152.

Letters to the editor from J. B. Goodman, Karl Schindler, C. L. Sullivan, and one anonymous commending Chemical Engineering for publishing and authors for writing the various cost articles published. The anonymous writer gave an estimate of time he was able to save on writing one particular report by using Mr. Denzler's article on blower and fan costs (ref. 193). The editor promises additional articles, similar to the latter, will appear and will cover cost aspects of heat exchangers, dust collectors, and electric energy generation and distribution.

114. _____. Progress in Air Filtration........ Vol. 60, No. 7, July 1953, pp. 124, 126.

Describes the design, operation, effectiveness and cost of the absolute air filter developed during the war by Arthur D. Little, Inc. Contains essentially the same cost information as ref. 385.

115. _____. Roll Call for Particle Sizes........ Vol. 60, No. 9, September 1953, pp. 250, 252.

Describes a new rapid, accurate instrument for particle size analysis of particles in the range from 1 to 100 microns. Gives investment cost of $4,750 for this machine.

116. _____. Sulfuric Triple Play. Vol. 59, No. 10, October 1952, pp. 226, 228.

Describes a method of utilizing spent sulfuric acid from an alcohol plant. Gives $500,000 as the yearly cost formerly incurred for neutralizing 3.5 million gallons of highly acid effluent weekly. Cost of a semiworks to produce synthetic alumina catalysts from spent acid was $250,000 and $250,000 additional was spent for its operation leading to the design of a new plant under construction. Estimated investment cost for the latter plant is $5,000,000.

117. _____. Trona → Soda Ash........ Vol. 60, No. 5, May 1953, pp. 118, 120.

Describes the new soda ash plant of Food Machinery & Chemical Corp. at Westvaco, Wyo. Includes brief summary of investment costs.

118. _____. Unveiling the Dynaclone Story........ Vol. 60, No. 11, November 1953, pp. 230, 232.

Presents results of an evaluation, in actual commercial operations, of a recently introduced cloth screen dust collector. Includes installed cost of filter with piping and auxiliaries, as well as some operating costs.

119. _____. Wood Challenges Corn As Dextrose Source. Vol. 61, No. 2, February 1954, pp. 138, 140, 142.

Describes the revised Rheinau wood hydrolysis process developed in Germany and compares in detail wood dextrose and corn dextrose production costs in the United States.

120. CHEMICAL AND ENGINEERING NEWS. AEC Releases Private Industry's Data on Nuclear Power Reactors. Vol. 31, No. 22, June 1, 1953, pp. 2294-2296.

Summarizes industrial reports on producing electrical power from nuclear energy. Includes brief summary of investment and operating costs for such plants. See also ref. 100.

121. _____. Atomic Energy - When? Where? How Much? Vol. 30, No. 27, Sept. 15, 1952, pp. 3808-3815.

Presents a lengthy question and answer interview with L. R. Hafstad, Director of the Division of Reactor Development, AEC, and includes some cost information on various types of reactors and nuclear power plants.

122. _____. Blaw-Knox Designs Packaged Unit for Continuous Fat Splitting Process. Vol. 31, No. 38, Sept. 21, 1953, pp. 3916, 3918.

Briefly describes this new packaged unit's design and operation and gives investment cost from $40,000 to $45,000 for a unit with rated capacity of 500 pounds per hour.

123. _____. Developments in Synthetic Liquid Fuels. Vol. 30, No. 32, Aug. 11, 1952, pp. 3248-3256.

Compares the Ebasco report[10/] of March 1952 and the National Petroleum Council subcommittee's report[11/] on production costs for synthetic fuels from coal hydrogenation.

124. _____. Handling of Nuclear Fuels Challenges Chemical Engineers. Vol. 31, No. 39, Sept. 28, 1953, pp. 3972-3973.

Summarizes the talk by Manson Benedict inaugurating the Division of Industrial and Engineering Chemistry's new lecture series at the 124th national ACS meeting. Includes brief estimate of costs of producing electrical power from nuclear energy.

125. _____. Industry Acess to Hottest Reactor. Vol. 32, No. 21, May 24, 1954, pp. 2106-2107.

Describes the materials testing reactor of AEC at Idaho Falls, Idaho. Gives $18,000,000 as the investment cost for this reactor with average neutron fluxes of 2×10^{14} thermal neutrons per square centimeter per second and 1×10^{14} fast neutrons per square centimeter per second.

126. _____. Industry Wants Bigger Role in Nuclear Power Development. Vol. 31, No. 14, Apr. 6, 1953, p. 1416.

Briefly summarizes talks on industry's role in nuclear power development presented at the 15th annual meeting of the American Power Conference at

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[10/] See footnote 5 under ref. 67.

[11/] National Petroleum Council. Synthetic Fuels Production Costs. Oct. 15, 1951, 555 pp.

Chicago, March 25-27, 1953. The summary of the talk by W. A. Cisler includes brief mention of electrical power costs from nuclear energy.

127. CHEMICAL AND ENGINEERING NEWS. Let the Theoretical Chemist Reduce Your Pilot Plant Studies. Vol. 31, No. 13, Mar. 30, 1953, p. 1297.

Presents a brief summary of papers on pilot plants given before the Division of Petroleum Chemistry at the 123d national ACS meeting. The summary of E. R. Roth's paper included the statement, "installed instrumentation costs for Atlantic's pilot units varies between 10 and 20 percent for units costing from $30,000 to $60,000, and up to 40 percent for bench scale units."

128. _____. Lift-Slab, Tilt-Up, A Modern Lab is Built Up. Vol. 31, No. 25, June 22, 1953, pp. 2606-2607.

Gives a pictorial presentation of a new research laboratory built in 22 days at a cost of $6.00 per square foot. Total area was 10,000 square feet.

129. _____. Maintenance Men in Cost Squeeze........ Vol. 32, No. 7, Feb. 15, 1954, p. 664.

Gives editorial comments on the 5th national Plant Maintenance and Engineers Conference and accompanying Plant Maintenance and Engineering Show held in Chicago. No actual costs given, but maintenance costs were discussed in general terms in this article.

130. _____. More Ammonia for the West. Vol. 31, No. 51, Dec. 21, 1953, pp. 5276-5277.

Describes Shell Chemical's new Ventura, Calif., anhydrous ammonia plant. Gives $10 million as the investment cost for this plant that will produce 150 tons of anhydrous ammonia per day. Gives $1 million as the investment cost for a sewage treating system that will supply 1,680,000 gallons of water daily to the plant.

131. _____. New Entry in Aromatic Sweepstakes. Vol. 31, No. 50, Dec. 14, 1953, pp. 5174-5175.

Describes Sun Oil's new aromatic chemicals plant at Marcus Hook, Pa. Gives $15,000,000 as the investment cost for this plant that has a yearly capacity of 19 million gallons each of benzene and toluene and 15 million gallons of xylenes. Includes the same cost information as, but somewhat different discussion than, ref. 268.

132. _____. NPC Says Synthetic Liquid Fuels Production is Uneconomic........ Vol. 31, No. 11, Mar. 16, 1953, pp. 1090-1091.

Briefly summarizes the conclusions reached by the National Petroleum Council in its study of synthetic liquid fuels production costs. Includes brief costs for producing synthetic fuels by Fischer-Tropsch, coal hydrogenation, and oil-shale processes.

133. _____. Petroleum → Cumene → Phenol....... Vol. 32, No. 12, Mar. 22, 1954, p. 1114.

Describes Standard Oil of California's new phenol plant at Richmond, Calif. Gives $4,000,000 as the investment cost for this plant that has a yearly capacity of 35 million pounds of phenol and 20 million pounds of acetone.

134. CHEMICAL AND ENGINEERING NEWS. Research Expenditures Show Fourfold Increase. Vol. 31, No. 6, Feb. 9, 1953, pp. 568-570.

Presents a breakdown, in graphic form, of research costs by industries, size of organizations, as percent of sales, per engineer or scientist, and related topics. See also ref. 144.

135. _____. Technology Needed to Pare Cost of Nuclear Power Units.... Vol. 30, No. 50, Dec. 15, 1952, pp. 5252, 5254.

Summarizes the talk by W. L. Davidson on nuclear power costs presented at National Association of Manufacturers meeting in New York on Dec. 5, 1952.

136. _____. World's Largest Houdriflow Cat Cracker Goes On Stream........ Vol. 31, No. 41, Oct. 12, 1953, pp. 4204-4205.

Describes the new Houdriflow cat cracker at the Texas City, Tex., refinery of Texas City Refining, Inc. Gives investment cost for this plant as $2,500,000. Gives daily feed capacity of plant as 12,500 barrels of vapor and 6,250 barrels of liquid and daily production capacity as 6,350 barrels of 96.5 octane gasoline.

137. _____. Wulff Acetylene. Vol. 31, No. 39, Sept. 28, 1953, pp. 3999-4000.

Gives brief comments, including costs, on producing acetylene by the Wulff process. Includes manufacturing costs and return on investment for recycle and once through operations with natural gas feed.

138. CHEMICAL WEEK. Accent on Cost. Vol. 74, No. 22, May 29, 1954, p. 64.

Presents brief editorial comments on the recent AICE meeting, at Springfield, Mass., that included a session on various phases of cost control. Papers were presented by M. D. Carpenter, Ralph De Simone, David Pierce, Winfield McNeil, Leonard Sedar, and J. F. Magee.

139. _____. 'Tween-Size Tanks. Vol. 72, No. 22, May 30, 1933, pp. 28, 30.

Describes a new series of tanks, from 300- to 4,000-gallon capacity, that fit into gondola cars and are used to transport chemicals. Tanks lease from $25 to $30 per month for large sizes and from $5 to $7 per month for small ones.

140. _____. Boxing the Compounds. Vol. 74, No. 3, Jan. 16, 1954, pp. 82, 84, 87.

Contains essentially the same cost information as ref. 110.

141. _____. Catalyst Christening. Vol. 72, No. 19, May 9, 1953, p. 18.

Briefly describes Davison Chemical's new $7,000,000 synthetic petroleum cracking catalyst plant at Lake Charles, La. It requires 9 men to operate the plant from 5 control panels. Capacity of plant is 45 million pounds of catalyst per year.

142. CHEMICAL WEEK. Cheaper Urea. Vol. 72, No. 16, Apr. 18, 1953, pp. 70, 72, 74.

This article presents considered views on fertilizer urea by Henry Wessel and William Niven, Jr., as requested by Chemical Week. Includes tables on cost of nitrogen carriers, rough estimated production cost of ammonium nitrate and urea, and estimated return on investment for urea production facilities.

143. _____. Cheaper With Miniatures. Vol. 73, No. 2, July 11, 1953, pp. 46, 48.

In the article a model engineer, Jeff Bowen, discusses trends and advantages of building-scale models of plants before plant construction begins. Estimates engineering model cost at 0.3 and training model cost at 0.1 percent of the total plant investment cost.

144. _____. C. W. Report: Industrial Research - The Big Picture. Vol. 73, No. 24, Dec. 12, 1953, pp. 40-44, 46, 48, 50.

Presents a discussion, graphically illustrated, of the industrial research picture. Gives breakdown, according to types of industries, of (1) the proportion of companies supporting research, (2) research outlay as a percent of net sales, (3) split between three channels of research expenditure in the chemical process industries, (4) increase in research spending over 1951, (5) expenditures per research worker, and (6) proportion of professional technical people among researchers. Uses some of same source information as ref. 134. Presentation in the two articles is different.

145. _____. C. W. Report: Shortages Coming, Count on Chemicals. Vol. 71, No. 1, July 5, 1952, pp. 25-26, 29-30, 33-34.

Gives a summary of the President's Materials Policy Commission Report on the materials problems that will have to be overcome to assure the nation's economic health for the next 25 years. Most figures presented are forecasts of quantities of materials that will be produced and required during that period, but a brief summary of synthetic fuels' production costs are included.

146. _____. Company Housing: Hobson's Choice. Vol. 73, No. 10, Sept. 5, 1953, pp. 16-17.

Discusses the pros and cons of company housing and includes some housing costs and rental figures.

147. _____. Culls to Chlorophyll. Vol. 73, No. 24, Dec. 12, 1953, p. 16.

Briefly describes a plant of Salinas Laboratories, Inc., in Salinas Valley, Calif., that will extract chlorophyll from lettuce culls. Plant capacity is 120 pounds of chlorophyll per day and investment cost is $200,000.

148. _____. .... Designed for Speed, Built for Comfort. Vol. 74, No. 22, May 29, 1954, pp. 62-64.

Describes the new quality-control laboratory at the Bonnie, Fla. plant of International Minerals & Chemical. Includes brief summary of equipment and labor saving's costs.

149. CHEMICAL WEEK. Electric Power Checklist. Vol. 72, No. 16, Apr. 18, 1953, pp. 56-57.

Discusses pros and cons of private electric power generation. Discusses briefly investment and depreciation costs and return on investment.

150. _____. The Electron: Freed for New Facts. Vol. 72, No. 25, June 20, 1953, pp. 54, 56, 58.

Discusses cathode radiation. Gives investment cost of $50,000 for a cathode ray generator unit that operates at 800,000 volts (but can go to 1 million volts) and 200-500 microampere on 180-cycle a.c. and generates 35 million roentgens per minute.

151. _____. Expansion Index. Vol. 74, No. 10, Mar. 6, 1954, p. 40.

Gives $630,000 as the investment cost for a new 4-story, air-conditioned research building comprising 12 laboratories, a conference room, and storage and office space.

152. _____. Fork Trucks on a Turnpike. Vol. 74, No. 2, Jan. 9, 1954, pp. 58-61.

Describes Veith Chemical plant, Fresno, Calif., that compounds insecticides and weed killers. Fork trucks do the lifting and the conveying work; figuratively speaking, the plant is built around these trucks. Contains brief investment and operating costs.

153. _____. Geared to the Long Term. Vol. 74, No. 16, Apr. 17, 1954, pp. 28-29.

Discusses capital expenditures in the chemical industry - actual 1953, planned 1954, and preliminary plans for 1955-57. Contains a graph showing what chemical companies plan to do if depreciation allowances are increased. Compares research expenditures of chemical firms with capital expenditures and sales.

154. _____. Hunting for Bargains in the Brine. Vol. 74, No. 24, June 12, 1954, pp. 38-40, 42, 44.

Summarizes activities in investigating means of obtaining fresh water from sea water. Gives brief costs for the electrolytic ion exchange process. These units range from 2,500 to 200,000 gallons of fresh water daily. Gives estimated initial cost for larger units as $1.50 per gallon per day capacity for units capable of removing 90 percent of the water's mineral content and $0.75 per gallon per day capacity if only 67 percent of the mineral content is removed.

155. _____. Leading Through Strength. Vol. 73, No. 9, Aug. 29, 1953, pp. 42-43.

Discusses transportation of caustic solutions and includes a brief summary of shipping costs.

156. _____. Make Water Do Double Duty. Vol. 73, No. 16, Oct. 17, 1953, pp. 82, 84.

Discusses the utilization of sewage effluent for obtaining additional water. Gives an actual case history as well as factors to consider when such action is contemplated. Lists treating costs per 1,000 gallons of water, at Big Spring, Tex., for use as boiler feed and for use as cooling tower makeup.

157. CHEMICAL WEEK. Marriage of Coal and Chemicals. Vol. 73, No. 11, Sept. 12, 1953, pp. 50-52.

Discusses Intermountain Chemical's trona plant at Green River, Wyo. Gives $30,000 per ton-day of output as the cost of an ammonia-soda plant at present prices.

158. _____. .... No Place for Frills. Vol. 74, No. 26, June 26, 1954, pp. 59-60, 62.

Describes Arthur D. Little's new research laboratories. Gives actual cost as $11.80 per square foot of floor area compared to from $25 to $60 per square foot for most new industrial buildings. Air conditioning, used only where needed, cost $10,000. Estimates savings of $10,000 to $12,000 per year on heating by using low-pressure steam.

159. _____. Outlook for the Oxide. Vol. 72, No. 21, May 23, 1953, pp. 46, 48, 50, 52, 54.

Discusses (1) the outlook for ethylene oxide production; (2) the two principal methods for producing ethylene oxide, namely, direct oxidation of ethylene and via ethylene chlorohydrin; and (3) estimated plant investment and production costs for the Lummus oxidation process. Estimates mid-1953 and 1955 ethylene oxide production capacities by companies for both processes.

160. _____. Oxygen Upstages Steam. Vol. 71, No. 9, Aug. 30, 1952, pp. 28, 30-31.

Briefly discusses a new method for producing hydrogen for ammonia manufacture using partial oxidation of natural gas with oxygen in place of steam. Includes some investment costs for this type of ammonia and urea plants and their auxiliary equipment.

161. _____. Partial Oxidation Premieres. Vol. 74, No. 8, Feb. 20, 1954, pp.62, 64.

Very briefly describes Spencer Chemical's new Vicksburg, Miss., plant for producing ammonia synthesis gas by the partial oxidation process. Estimates 6 percent lower operating costs and 15 percent less fuel requirement per given output than conventional processing.

162. _____. Plan for Planners. Vol. 72, No. 17, Apr. 25, 1953, pp. 32, 34.

Discusses "operations diagnosis" - its principles and application to research planning. Gives purposes of "operations diagnosis" as; (1) to analyze the problems of the company to see where research should be applied and (2) to evaluate technical and economic risks associated with the alternative research programs so a realistic selection can be made. Gives a hypothetical illustration.

163. _____. Plastics Tool: "Hot" Box on Rails. Vol. 74, No. 25, June 19, 1954, pp. 50-52.

Summarizes the paper, presented at the Cleveland meeting of the Society of the Plastics Industry by David Ballantine, in which he described a possible mobile nuclear reactor. Gives economics of reactors used solely as ionization sources for polymerization.

164. CHEMICAL WEEK. .... Primed for Action. Vol. 74, No. 6, Feb. 6, 1954, pp. 64, 66-69.

Describes newly developed "canned" pumps that eliminate the stuffing box and seal. Includes costs for various types and sizes of pumps, as well as, estimated reduction in maintenance costs for these new pumps over the conventional types.

165. _____. Reactors Proceed, Law Stands Still. Vol. 72, No. 23, June 6, 1953, pp. 16-18.

Discusses the present legal situation, recent moves by AEC toward private ownership and development of atomic power, and anticipated Congressional attitudes. Includes a technical summary of industry atomic power plans, which contains estimated costs for various proposed nuclear power plants and one coal-fired plant.

166. _____. Saves Twenty Times Its Cost. Vol. 71, No. 19, Nov. 8, 1952, p. 59.

Editor summarizes an interview in which W. L. Duncan explained the essentials and advantages of a cost-control program.

167. _____. Statistics Can Make Sales. Vol. 71, No. 24, Dec. 13, 1952, p. 69.

Lists several government sources of statistical information for a number of subjects, some of which are of interest to cost estimators. Subjects include such items as wages, prices, production and sales figures, economic trends, etc.

168. _____. Still No Profit in Shale. Vol. 72, No. 10, Mar. 7, 1953, p. 13.

Briefly summarizes the National Petroleum Council's estimate of investment costs for producing liquid fuels from coal hydrogenation, Fischer-Tropsch reaction, and oil shale.12/ Gives cost of gasoline from oil shale as from 14.7 to 16.2 cents per gallon.

169. _____. Stumbling Block to Plant Expansion. Vol. 71, No. 15, Oct. 11, 1952, pp. 21-22, 24, 26, 28.

Editor summarizes an interview with J. A. Sargent that was undertaken to discuss the present pared profit margin as it affects management. Includes some investment and operating costs. One table compared 1940 and 1951 investment and operating costs and profits for a 1,000-ton-per-day soda ash plant and a 200-ton-per-day electrolytic chlorine alkali plant with power facilities.

170. _____. Superficially Similar, Fundamentally Different. Vol. 74, No. 18, May 1, 1954, pp. 28-30.

12/ See footnote 11 (see ref. 123).

Briefly describes Foster Grant's new styrene monomer plant at Baton Rouge, La. Gives $4,000,000 investment cost for this 12,000-ton-per-year plant. Gives no operating costs for this plant but states that the Reconstruction Finance Corporation reported 8.76, 9.23, and 8.68-cents-per-pound operating costs for the last 3 years at the Dow-operated Los Angeles plant.

171. CHEMICAL WEEK. Time Out for Maintenance. Vol. 74, No. 7, Feb. 13, 1954, p. 56, 58.

Article comments about the recent Plant Maintenance & Engineering Conference at the Conrad Hilton Hotel in Chicago and summarizes the discussion of pros and cons of preventive maintenance presented by O. W. Gravely. He discussed his experiences at Electro Metallurgical's Niagara Falls plant. Gives $2,000 per month repair costs for a coke-oven drying system with 65,000 tons yearly output; after preventive maintenance was introduced maintenance costs were reduced to $1,600 per month and output climbed to 100,000 tons per year.

172. _____. .... Toward a Balance. Vol. 71, No. 22, Nov. 29, 1952, pp. 23-24.

Compares corporation and cooperative fertilizer plant investments.

173. _____. Wage Arrow Points South. Vol. 73, No. 20, Nov. 14, 1953, pp. 30-32, 34.

Describes the wage picture throughout the United States. Shows the wage rate for each State and gives the highest and lowest average wage rates for 1929, 1933, 1937, 1947-52, and July 1953 for various locations.

174. _____. What Price Sulfuric? Vol. 71, No. 10, Sept. 6, 1952, pp. 42, 44-47.

Editor summarizes an interview with H. E. Wessel and E. O. Holmes regarding their recently completed economic study of sulfur, with emphasis on making sulfuric acid. Article includes tables showing cost per ton of acid from sulfur, from smelter gas, and from sulfur pyrite.

175. _____. Who'll Boost Falls' Power? Vol. 73, No. 5, Aug. 1, 1953, pp. 40-44.

Discusses Niagara Falls' power-expansion problem. Includes a graph showing average power costs for chemical and allied industries for 1950, 1951, and 1952, as supplied by Ontario Hydroelectric (Niagara Falls, Canada), Niagara Mohawk (Niagara Falls, N. Y.), Tennessee Valley Authority, and Bonneville.

176. CHISWELL, E. B., and MERRILL, J. J. For a Petrochemical Project, These Capital Cost Considerations........ Petrol. Refiner, vol. 33, No. 6, June 1954, pp. 127-130.

Discusses a few of the financial considerations behind the management decision to install or not to install a plant. Touches on subjects such as corporation tax level, payout period, choice of competing process, depreciation, and return on investment. Uses ethylene oxide manufacture by direct oxidation and via ethylene chlorohydrin to illustrate the above points. Includes investment and operating costs for the two processes.

177. CONNORS, J. S. Good Heat-Exchanger Maintenance Pays Off........ Oil Gas Jour., vol. 51, No. 36, Jan. 12, 1953, pp. 105-106.

Discusses types of scale deposits, fouling factors, and effect of delayed maintenance and includes installation costs of various heat exchangers and savings made by proper maintenance.

178. COTTRELL, C. E. Pro & Con: More on Estimation of Vessel Costs. Chem. Eng., vol. 60, No. 2, February 1953, p. 143.

This is a letter from C. E. Cottrell to the editor discussing predesign cost estimates. Includes a graph based on a slight modification of the method described by Cecil Chilton.[13] The graph shows installed and delivered vessel costs vs. volume capacity.

179. CRITTENDEN, E. D., JR., and HIXSON, A. N. Extraction of Hydrogen Chloride From Aqueous Solutions. Ind. Eng. Chem., vol. 46, No. 2, February 1954, pp. 265-274.

Presents results of phase equilibrium studies on extraction of hydrogen chloride from aqueous solutions. Gives $1 million as the estimated investment cost for a plant able to produce 20,000 tons of 18° Be acid per year from a waste stream containing 5 percent acid. Estimates 8 percent per year return on investment for this plant.

180. CROOKS, W. R. Precooling Engine Combustion Air. Part 1. How to Condition Combustion Air. Oil Gas Jour., vol. 52, No. 19, Sept. 14, 1953, p. 151; Part 2. What Combustion Air Conditioning Accomplishes. Oil Gas Jour., vol. 52, No. 21, Sept. 28, 1953, p. 141.

Part 1 contains no cost information. Part 2 briefly discusses engine performance and presents a cost summary for combustion air conditioning. The cost information in part 2 is the same as that in ref. 181. Parts 1 and 2 include a good portion of the information in ref. 181.

181. _____. Savings Effected by Precooling Engine Combustion Air. Petrol. Eng., vol. 26, No. 6, June 1954, pp. C-19-21, 24-26.

Discusses (1) what changes have been taking place to make combustion air conditioning profitable; (2) various methods of combustion air conditioning; and (3) specific gains and possible engine plant adaptions resulting from, or aided by, the use of combustion air conditioning. Includes brief summary of conditioning equipment and possible savings. Contains the same cost information as ref. 180 but somewhat more extensive discussion than the latter.

182. CULBERTSON, LEROY, and CONNORS, J. S. Desulfurization and Dehydration of Natural Gas........ Petrol. Eng., vol. 24, No. 10, September 1952, pp. D-10, 12, 14, 16, 18, 20.

Discusses several desulfurization and two dehydration processes. Includes a table showing investment and operating costs for a pipeline desulfurizer for daily treatment of 100 million standard cubic feet of gases (at 500 pounds per square inch) that are 1, 3.5, and 6 percent acidic. Also contains another table showing investment and operating costs for glycol-type and dry desiccant-type pipeline dehydrators with daily capacities of 100 million standard cubic feet. Contains essentially the same information as combined refs. 183 and 184.

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[13] Chilton, C. H. Cost Data Correlated. Chem. Eng., vol. 56, No. 6, June 1949, pp. 97-106.

183. CULBERTSON, LEROY, and CONNORS, J. S. How to Prevent Formation of Gas Hydrates. Oil Gas Jour., vol. 51, No. 15, Aug. 18, 1952, pp. 114, 116.

This reference together with ref. 184 constitutes essentially the same information as ref. 182.

184. _____. How to Rid Natural Gas of Undesirable Sulfur Compounds. Oil Gas Jour., vol. 51, No. 14, Aug. 11, 1952, pp. 114-115, 117.

This reference together with ref. 183 constitutes essentially the same information as ref. 182.

185. CZINER, R. M. How to Control Maintenance Costs........ Petrol. Refiner, vol. 33, No. 1, January 1954, pp. 106-109.

Discusses how to control maintenance costs and gives a number of suggestions for improving maintenance operations. Includes a table of 1951 expenditures for maintenance materials and equipment and for maintenance labor for the chemical and allied products industry and for the fertilizer and coal products industry.

186. DALLAVALLE, J. M. How to Estimate Dust-Collector Costs. Chem. Eng., vol. 60, No. 11, November 1953, pp. 177-183.

Mentions three applications of dust-collecting equipment, namely, (1) recovery of material having an economic value; (2) collection of materials dangerous to health and safety of employees and residents in the neighborhood of a discharge point; and (3) use to eliminate general atmospheric nuisances. Discusses in detail various types of equipment and their applications and includes costs, January 1, 1952, basis, for these types of equipment.

187. D'AQUIN, E. L., VIX, H. L. E., SPADARO, J. J., GRACI, A. V., JR., EAVES, P. H., REUTHER, C. G., JR., MOLAISON, L. J., McCOURTNEY, E. J., CROVETTO, A. J., GASTROCK, E. A., and KNOEPFLER, N. B. Pilot Plants: Filtration-Extraction of Cottonseed. Ind. Eng. Chem., vol. 45, No. 1, January 1953, pp. 247-254.

Discusses a new process that apparently overcomes the usual difficulties encountered in direct solvent extraction of cottonseed. Gives no actual cost figures but estimates overall plant investment cost for this new plant, with a capacity of 100 tons per day, would be somewhat lower than for a conventional direct extraction plant of the same capacity. Refers to an article by Persell and coworkers[14/] that states for extraction and desolventization equipment the investment costs would be 15 percent lower than those for conventional equipment.

188. DAVIDSON, W. L. Oil and the Atom.... Partners.... or Competitor?........ Oil Gas Jour., vol. 52, No. 28, Nov. 16, 1953, pp. 263-264, 266-267, 269-271.

[14/] Persell, R. M., Pollard, E. F., Deckbar, F. A., Jr., and Gastrock, E. A. Cotton Gin & Oil Mill Press, vol. 53, No. 17, 1952, pp. 18-20.

Briefly discusses (1) various oil-industry applications of radioactivity and radioactive compounds; (2) atomic potential - central station power plants, package power units, and nuclear power for propulsion; and (3) policy problems. Gives examples of how radioactive tracer studies help reduce costs.

189. DAVIDSON, W. L. Partners or Competitors? Oil and the Atom. Petrol. Eng., vol. 26, No. 1, January 1954, pp. E-1, 6, 8, 13, 15-17, 20.

Contains essentially the same information as ref. 188.

190. DAY, S. G. .... Victory Field to Store Gas From Gulf Interstate Pipe Line. Oil Gas Jour., vol. 52, No. 20, Sept. 21, 1953, pp. 328, 334.

Briefly discusses adaption of the old Victory field in West Virginia to store gas. Gives $500,000 as the investment for the compressor station with 1,760 hp., a working pressure of 1,000 p.s.i., and a daily capacity of 20,000,000 cu. ft. of gas.

191. DEGNEN, W. J., and SKELLY, J. F. Design and Operation of Orthoflow Units. Petrol. Eng., vol. 25, No. 8, Reference Annual 1953, pp. C-7-10.

Contains no actual costs but gives comparative percentage savings in investment costs of orthoflow units over balanced pressure units.

192. deJAER, A. Readers Views & Comments: Put Statistics to Work. Chem. Eng., vol. 59, No. 7, July 1952, p. 306.

This is a letter to the editor from A. deJaer commenting on an article by P. Ferencz[15/] and asking for information about textbooks on statistics that would be well suited for practical purposes such as this.

193. DENZLER, R. E. Blower and Fan Costs........ Chem. Eng., vol. 59, No. 10, October 1952, pp. 130-134.

Gives extensive easy-to-use cost information for three basic types of air-moving equipment, namely, (1) axial flow propeller fans and blowers; (2) radial flow centrifugal fans and blowers; and (3) positive rotary blowers, gas pumps, and compressors.

194. DESAI, A. M. Plant Engineering Memos: New Notes; Silk Purses From Sows Ears. Ind. Eng. Chem., vol. 46, No. 2, February 1954, pp. 111A-112A.

Discusses Houdry oxycat use in oxidizing solvent pollutants from Enamelstrip's baking ovens. Claims fuel bill reduction of 90 percent, or $3,000, that paid off the investment in the first 6 months.

195. DEVINE, J. P. Efficient Methods to Keep Spare Parts Records........ Petrol. Eng., vol. 25, No. 6, June 1953, pp. C-16, 18.

Discusses central control of acquisition and inventories of spare parts. Shows prices of a number of equipment items and shows how savings in spare parts' purchases were made.

[15/] Ferencz, Paul. Statistics Can Put More Meaning Into Your Cost Estimates. Chem. Eng., vol. 59, No. 4, April 1952, pp. 143-147.

196. **DONOVAN, JAMES.** Cost Estimation, Fabricated Plate Equipment. Chem. Eng. Prog., vol. 50, No. 6, June 1954, pp. 320-323.

Gives basic presentation of the elements and techniques involved in practical cost estimation of fabricated equipment. Includes design, properties, and costs of materials and examples of cost calculations for a small pressure vessel.

197. **DOTTERWEICH, F. H.** Technical Forum: Cracking Natural Gas. Petrol. Eng., vol. 25, No. 6, June 1953, pp. C-44-46.

F. H. Dotterweich answers the question submitted by H. C. D., "What are the essential process details and the economics of cracking natural gas and/or light hydrocarbons - propane, butane, etc. - to produce commercial fuel gas?" The answer describes both thermal and catalytic cracking or reforming operations and in the last paragraph summarizes the economics of gas cracking or reforming operations. Dotterweich refers to a very complete report on replacements for natural gas worked up by H. M. Henry and presented before the American Gas Association, 420 Lexington Ave., New York 19, N. Y.

198. **DOUGHERTY, R. P.** How Dehydration Curtails Corrosion in Pipe Lines. Oil Gas Jour., vol. 51, No. 17, Sept. 1, 1952, pp. 94-95, 98, 157.

Discusses reduction of internal corrosion in the desiccant dehydration system of a products' pipeline. Gives the following 1951 operating costs for a 20,000-barrel-per-day dehydrator:

	Dollars per 1,000 bbl.
Labor	0.47
Gas and electric	.20
Desiccant replacement	.17
Maintenance (materials)	.06
Total	.90

When operating at full 20,000-barrel capacity the cost is only $0.68 per 1,000 barrels.

199. **DOWNS, G. F., JR., and TAIT, G. R.** Short-Cut Method of Selecting Pipe-Line Diameter for Minimum Investment........ Oil Gas Jour., vol. 52, No. 28, Nov. 16, 1953, pp. 210-214, 319.

Article presents a simplified method for rapidly reaching a decision on the economic pipe size to be used in transporting given quantities of petroleum products. Contains numerous graphs, nomographs, and equations and demonstrates their use.

200. **DUNN, C. L., and LIEDHOLM, G. E.** Shell Extractive Distillation Process for Recovery of High-Purity Aromatics........ Petrol. Eng., vol. 24, No. 8, Reference Annual 1952, pp. C-7-10.

Describes Shell's extractive distillation process and includes operational and product properties data. Gives costs for operating labor and for maintenance labor and materials.

201. **DUVAL, C. A., and KALICHEVSKY, V. A.** Dualayer Gasoline Treating Process .... Petrol. Refiner, vol. 33, No. 4, April 1954, pp. 161-163.

Describes the dualayer process for mercaptan removal from absorption, thermal, and straight run gasolines and gives typical tetraethyllead savings for dualayer process over doctor-treating.

202. _____. New Gasoline Treating Process Removes All Mercaptans. Petrol. Eng., vol. 26, No. 4, April 1954, pp. C-106-108.

Contains essentially the same information as refs. 201, 203, and 204.

203. _____. Treating Gasoline by Dualayer Process. Oil Gas Jour., vol. 52, No. 49, Apr. 12, 1954, pp. 122-123, 150-151.

Contains essentially the same information as refs. 201, 202, and 204.

204. _____. Twist a Problem Into a Profit. Petrol. Proc., vol. 9, No. 5, May 1954, pp. 691-693.

Contains essentially the same information as refs. 201, 202, and 203.

205. **ECKHOUSE, J. G.** Platforming. Petrol. Eng., vol. 26, No. 4, April 1954, pp. C-26, 29.

Describes Universal Oil's reforming process and gives the following economics for a unit with a 1,000-barrel-per-day feed capacity:

Operating cost	cents per bbl. of feed	4 - 5
Catalyst	do.	4
Operating labor	do.	4 - 5
Royalty	do.	6
Taxes, insurance, maintenance	do.	7 - 10
Investment cost per daily bbl. of feed capacity	dollars	150 - 300

206. **ECKHOUSE, J. G., and KEIGHTLEY, W. A.** Fluid Cat Cracking. Petrol. Eng., vol. 26, No. 4, April 1954, pp. C-96-98, 100.

Discusses design, operation, and operating cost of Universal Oil's fluid catalytic cracking (FCC) process and gives advantages claimed over other processes. Gives an approximate operating cost figure of $0.44 per barrel of feed for the FCC unit together with the gas concentration unit for recovery of light gases and stabilization of the gasoline.

207. **EGLOFF, GUSTAV.** Report to Refiners. Petrochemicals Unlimited........ Oil Gas Jour., vol. 51, No. 49, Apr. 13, 1953, pp. 124, 126-127, 129-135.

Contains general discussion of commercial petrochemical development and mentions an investment cost of $30,000,000 for a plant that can produce 30 million pounds of acrilan per year.

208. **EICHELMANN, J. F.** Gas Turbines in Intermediate Stations........ Petrol. Eng., vol. 24, No. 8, Reference Annual 1952, pp. D-38, 40-42.

Presents the thoughts of El Paso Natural Gas's experts with reference to the mainline gas-transmission-system design, and application of gas turbines to increasing the size of the system. Gives graph plotting total cost per mile vs. increase in sales capacity for several alternative compressor station setups.

209. ELD, A. C. ....7. Gulf's Perforated Plate........ Oil Gas Jour., vol. 52, No. 51, Apr. 26, 1954, pp. 180, 183, 186, 190.

Discusses design and operation of the above type of column tray and compares cost estimates for Gulf's bubble cap and Gulf's perforated plate, 8,000-barrel-per-day deisopentanizers. Gives cost of trays, tray installations, tower shell, and insulation. Also shows an economic comparison of tower design for bubble cap and perforated-plate types for both depropanizers and debutanizers.

210. EL-DIB, I. A., and HUNTINGTON, R. L. Economics of Reducing Crude-Oil Vaporization Losses. Oil Gas Jour., vol. 51, No. 44, Mar. 9, 1953, pp. 90-92, 94.

Discusses installation cost, evaporation loss reduction, payout time, and savings resulting from cooling crude oil before sending it to lease-tank storage. Lists factors to consider in designing the exchanger and steps to follow in determining the economics of the system, together with data and examples to illustrate the method.

211. ELLERBRAKE, E. G., and VEATCH, F. New Foam Cuts Evaporation Losses. Oil Gas Jour., vol. 52, No. 28, Nov. 16, 1953, pp. 223-224, 322.

Discusses results of field tests on use of plastic foam to reduce evaporation loss during storage. Gives costs of one-half inch layer of foam for several size tanks. Shows total installed cost of foam vs. tank size (in barrels and by diameters). Also includes some figures on estimated savings from reduced evaporation losses. Contains essentially the same cost information as ref. 212, but includes more test data than the latter.

212. _____. Reduce Evaporation in Cone Roof Tanks With Plastic Foam........ Petrol. Refiner, vol. 33, No. 1, January 1954, pp. 137-141.

Contains essentially the same cost information but does not include quite as much test data as ref. 211.

213. ENGLUND, S. W., ARIES, R. S., and OTHMER, D. F. Synthesis of Cresol........ Ind. Eng. Chem., vol. 45, No. 1, January 1953, pp. 189-197.

Discusses in detail the two steps involved in synthesizing cresol by the sulfonation method, namely: (1) Sulfonation of toluene, and (2) caustic fusion of toluene sulfonic acid. Gives the following economic summary for a plant capable of producing from 5 to 10 million pounds of phenol per year:

Plant investment.............	millions of dollars	4.5
Phenol raw materials cost..........	cents per lb.	7.7
Utilities[16]	do.	1.0
Labor[16]	do.	1.7
Depreciation	percent of plant investment	10
Overhead	do.	10
Repairs and maintenance	do.	15

Article also includes estimated cost data for another type of phenol plant in the United States, which was derived from German experience with the German chlorination process. Again, except for raw material cost, the cost figures would be applicable to an equivalent amount of cresol production.

214. ENRIGHT, R. J. Gas-Turbine Report. Oil Gas Jour., vol. 52, No. 51, Apr. 26, 1954, p. 116.

This is an abstract of a paper presented by T. S. Parks at the 3d annual convention of the Natural Gasoline Association of America. States that El Paso Natural Gas claims its pipeline operations show that gas-turbines have operating costs, less fuel requirements, of $8.25 per horsepower per year, compared to $22.10 for reciprocal units.

215. EPPARD, J. H., SIMS, W. F., and PARKER, F. D. Critical Economic Factors of Reducing Fuel Oil by Residuum Coking........ Petrol. Refiner, vol. 32, No. 7, July 1953, pp. 98-101.

Article analyzes coking processes from the standpoint of (1) development of coking processes, (2) economic incentives for new investment, and (3) market potential for petroleum coke. One table presents economics of Blaw-Knox's decarbonizing process of 10,000-barrel-per-day capacity; another table appraises coking vs. fuel oil from both investment and profit standpoints; and a third table shows investment and operating costs for acetylene production from calcium carbide.

216. ERICKSON, H. W. Types of Grinding Mills and When to Use Them. Chem. Eng. Prog., vol. 49, No. 2, February 1953, pp. 63-68.

Gives no actual costs but concludes "Since the economics of a grinding mill is usually based on a cost per pound or per ton of finished product, cost of maintenance of the mill is of prime importance. Maintenance costs consist mainly in replacement of grinding surfaces and time cost in making such replacements."

217. EVANS, L. P., MAGIN, K. E., SAVOCA, J. I., and SHEA, H. W. TCP Process Offers These Advantages........ Petrol. Refiner, vol. 32, No. 5, May 1953, pp. 117-122.

Discusses the thermofor continuous percolation process for decolorizing lubricating oils and waxes. Gives unit design, properties of charge and product, and operating data. Includes economic comparison of TCP and hot contacting and static percolation. Contains the same cost information as ref. 218, but includes more extensive test data than the latter.

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[16] These apply to phenol production. All costs, except raw material cost, would be the same for equivalent cresol production, since processing is similar for both products.

218. EVANS, L. P., MAGIN, K. E., SAVOCA, J. I., and SHEA, H. W. Thermofor Continuous Percolation.... New Process for Decolorizing Lubricating Oils. Oil Gas Jour., vol. 52, No. 5, June 8, 1953, pp. 116-118, 120.

Contains the same cost information but does not include as much test data as ref. 217.

219. EVERETT, R. W. Chemical Economics. Government Statistics Can Help You........ Chem. Eng., vol. 61, No. 2, February 1954, pp. 353-358.

Article tells "Where to go within our government to get reliable statistics on a number of items."

220. FARRAR, G. L. Flexibility.... It's a Must in Petrochemical Plants Today. Oil Gas Jour., vol. 53, No. 2, May 17, 1954, pp. 94-98.

Discusses the necessity of designing petrochemical plants, so they will "be extremely flexible in utilization of raw materials, capacity, and product distribution." One table shows overall economic summary of severe cracking 10,000 barrels of paraffinic crude oil per stream day. Gives transportation cost for shipping anhydrous ammonia.

221. _____. Here's a "How to" Primer on Chemical Cleaning of Refining Equipment. Oil Gas Jour., vol. 51, No. 46, Mar. 23, 1953, pp. 211-212, 215, 219, 223-224, 226, 230, 232, 235.

Discusses chemical cleaning and techniques employed. Includes some cost information and lists other articles on chemical cleaning.

222. _____. Here's What's Happening in Mitigating Corrosion in Process Equipment: Cathodic Protection of Heat-Transfer Equipment. Oil Gas Jour., vol. 51, No. 52, May 4, 1953, pp. 104-105.

Presents a resume of a paper presented by R. W. Stetson and Burke Douglas at the annual meeting of National Association of Corrosion Engineers in Chicago. Discusses cathodic protection of heat exchangers and condensers. Gives savings of $5.00 for each $1.00 expenditure.

223. _____. Here's What's Happening in Mitigation of Pipe-Line Corrosion. Part 1. Cable-System Design for Rectifiers. Oil Gas Jour., vol. 51, No. 50, Apr. 20, 1953, pp. 148, 150; Part 2. Cathodic Protection in High-Resistivity Soil. Oil Gas Jour., vol. 51, No. 50, Apr. 20, 1953, pp. 150, 153.

Part 1 summarizes a paper presented by R. M. Wainwright at the annual meeting of National Association of Corrosion Engineers in Chicago. Discusses basic design factors, environmental requirements, and Kelvin's economic law. This law is defined and equations for determining its components are given. "The law states that the proper cable size is one which makes the sum of the annual cost of the losses and the annual fixed charges a minimum." Part 2 summarizes a paper presented by H. C. Van Nouhuys at the meeting referred to in Part 1. Describes a refined products' pipeline and its protection. Contains a summary of costs of rectifier system installations, power, maintenance, and protection.

224. **FARRAR, G. L.** Lube Plant Operating. Oil Gas Jour., vol. 52, No. 12, July 27, 1953, pp. 214-215.

Briefly discusses Deep Rock Oil's new solvent lubricating-oil plant at Cushing, Okla. Gives investment cost as $2,500,000 for this plant that utilizes phenol extraction and propane deasphalting. The daily capacity of the propane unit is 1,050 barrels of feed, and that of the phenol unit is either 2,000 barrels of neutrals or 1,150 barrels of cylinder stock.

225. _____. Tiny Balloons Cut Evaporation........ Oil Gas Jour., vol. 52, No. 10, July 13, 1953, pp. 74-75.

Discusses Sohio's new method for storage-evaporation loss reduction. Gives data on composition, size, and effectiveness of these tiny balloons. Includes a preliminary cost figure of 80 cents per pound. See ref. 211 or 212 for later information and firmer cost figures on this subject.

226. **FEAGAN, R. A., LAWLER, H. L., and RAHMES, M. H.** Check this.... Experience With Amine Units. Petrol. Refiner, vol. 33, No. 6, June 1954, pp. 167-168.

Gives "ten design hints and five operating hints that can cut corrosions, amine losses, and upsets" in amine treating units. Includes brief summary of operating costs.

227. _____. H_2S Removal for $76 Per Million Feet. Oil Gas Jour., vol. 52, No. 51, Apr. 26, 1954, pp. 280, 282, 285, 287-288.

Contains essentially the same information as ref. 226.

228. **FERENCZ, PAUL.** Readers Views & Comments: Statistics: Estimate a Range. Chem. Eng., vol. 59, No. 10, October 1952, pp. 254, 256.

This is P. Ferencz's reply to a letter to the editor by W. R. Ludka (ref. 334) explaining why the figure 5.2 was used. Consult ref. 334 for explanation of the 5.2 value.

229. **FERNSIDE, T. A., and CHENEY, F. C.** Fast Estimate for Power Plant Costs........ Chem. Eng., vol. 60, No. 6, June 1953, pp. 239-241.

Presents a set of simple factors that can "be applied to readily obtainable purchase costs of major equipment items to give rapid and reasonably accurate determination of the major portion of the total project costs for an industrial power plant. These factors take into account variables such as steam requirements, special turbine steam extraction or back pressure conditions, and in addition, the current level of market prices".

230. **FISK, H. G.** Resources for the Chemical Industry in the United States. Rocky Mountain States Part I (Raw Materials), Wyoming. Ind. Eng. Chem., vol. 45, No. 11, November 1953, pp. 2449-2454.

This discussion of Wyoming's natural resources includes the following summary of costs for producing anhydrous ammonia:

Plant capacity, tons per day	Cost of anhydrous ammonia, dollars per ton, from Coal	 Natural gas
200	47.00	37.85
400	34.25	32.45
600	29.80	30.25

Gives $20 million as investment cost of Intermountain Chemical's 300,000-ton-per-day trona plant at Green River, Wyo.

231. FLETCHER, G. R. Put High-Pressure Gas to Work With Gas Jet Compressors........ Petrol. Refiner, vol. 33, No. 2, February 1954, pp. 107-111.

Discusses extensively the principles, construction, and operation of gas jet compressors. Gives $5,000 as the investment for a single unit able to compress 10,000 std. cu. ft. of gas per day from 600 to 800 or 900 p.s.i.g. Says the cost per unit in multiple units drops. Claims installation costs are low since no foundations are needed.

232. FOHL, H. A. Area Versus Centralized Maintenance. Petrol. Refiner, vol. 32, No. 6, June 1953, pp. 109-112.

Gives an actual case history for comparing the two types of maintenance systems and includes comparative savings.

233. FOLZ, J. M., MAHAN, J. E., and WHITE, D. H. Phillips Synthesize Pyridines. Petrol. Proc., vol. 7, No. 12, December 1952, pp. 1802-1803.

Describes the first commercial plant to synthesize methylvinyl pyridine from petroleum raw materials. Includes reactions and flow diagram. Gives $3,100,000 as the investment cost, but does not give plant capacity.

234. FONTANA, M. G. Corrosion: Part 1. Ind. Eng. Chem., vol. 46, No. 1, January 1954, pp. 103A-105A; Part 2. Ind. Eng. Chem., vol. 46, No. 2, February 1954, pp. 85A-87A.

Part 1 discusses progress in titanium and developments needed for its extensive use in the chemical process industries. Gives the following costs for titanium manufacture and finished products:

	Dollars per pound
Raw materials	5
Wrought products:	
Sheet	20
Forgings	11
2-inch rounds	10
Wire	35

Part 2 briefly reviews papers presented in the American Society for Metals educational lecture series on Surface Protection against Corrosion at the National Metals Congress in Cleveland in October 1953. Gives several examples of costs for painting, preparation, scaffolding, cleanup, and metallizing.

235. FORBES, M. C. Handbook to Water Problems and their Solutions, Part 1. Water Supply and Quality. Petrol. Refiner, vol. 33, No. 4, April 1954, pp. 122-126.

Discusses what items should be considered and methods employed to solve the problem of water supply and quality. Gives operating and/or investment costs for drilling water wells; dam design and construction; forced draft aerators; deaerating equipment used on boilers; pressure filters; anion exchangers; and other types of ion exchange equipment.

Part 2. Water Analysis and Interpretation and Part 3. Scale appear in later issues but contain no cost information.

236. FORRESTER, J. H., CONN, A. L., and MALLOY, J. B. A New Low-Pressure Catalytic Reforming Process, Ultraforming........ Oil Gas Jour., vol. 52, No. 49, Apr. 12, 1954, pp. 139-142.

Discusses this new low-pressure platinum-catalyst reforming process. Gives, for operation at 300 p.s.i., estimated catalyst replacement cost at about $4 per pound. Estimates catalyst cost is less than 4 cents per barrel - no more than cracking catalyst cost.

237. _____. Ultraforming - New Refining Process........ Petrol. Refiner, vol. 33, No. 4, Apr. 1, 1954, pp. 153-156.

Contains essentially the same information as ref. 236.

238. FOSKETT, N. L., and FOSTER, R. C. Exemplified in the Gabe, Ky., Extraction Plant.... Hydrocarbons From Pipe-Line Gas........ Petrol. Refiner, vol. 32, No. 9, September 1953, pp. 116-117, 120-121.

Discusses design considerations for extracting hydrocarbon feed stocks for petrochemical plants from pipeline gas in the North Central and Middle Atlantic States. One table presents the investment costs for plants (300,000,000-standard-cubic-feet-per-day capacity) to recover 29.7 and 42.0 percent, respectively, of ethane in the pipeline gas, as well as the C_3-plus hydrocarbons.

239. FOSTER, A. L. Corrosion Problems, New Processes Mark Refiners' Meet. Petrol. Eng., vol. 25, No. 6, June 1953, pp. C-39, 42.

Briefly summarizes papers presented at the 18th mid-year meeting of the Refining Division of the American Petroleum Institute at New York City on May 11-14, 1953. Abstracts cover Shell's hydrodesulfurization process, autofining, houdriforming, and thermofor continuous percolation (TCP) processes, including some investment and operating costs; gives costs for inhibiting tower-top and overhead-system corrosion during crude oil distillation; and shows comparative fuels' costs per 1,000 miles for diesel-, gasoline-, and L.P.G.-powered vehicles.

240. _____. .... Ethylene Production Methods. Petrol. Eng., vol. 25, No. 9, August 1953, pp. C-35-36.

Briefly discusses methods by which ethylene can be produced. Gives 3.8 and 2.0 cents per pound as the costs for producing ethylene from propane and ethane, respectively, when both feeds cost 5 cents per gallon. Gives cost of acetylene as 11 cents or more per pound if it is made from calcium carbide.

241. FOSTER, A. L. Petrochemical Capacities Hit New Highs. Petrol. Eng., vol. 25, No. 4, April 1953, pp. C-69-70, 72-77.

Presents a survey of 1953 petrochemical operations, including a lengthy table showing plants, location, status, approximate investment, and related subjects. This article is indexed only for these products for which both plant capacity and investment costs are given.

242. _____. Petrochemicals - for Clothing or Fertilizer. Petrol. Eng., vol. 25, No. 7, July 1953, pp. C-3-6.

Gives general discussion of current status of petrochemical industry and includes a table similar to that in ref. 241.

243. _____. .... Phenol, Acetone From Cumene........ Petrol. Eng., vol. 25, No. 12, November 1953, pp. C-3-4.

Briefly discusses production growth and general uses of phenol and acetone, including a description of the three major synthetic phenol processes with emphasis on the one involving oxidation of cumene. Gives $10 million as estimated investment cost for a plant with annual capacity of 50 million pounds of phenol and 30 million pounds of acetone. Gives 3.1 cents per pound of coproduct (phenol and acetone) as total cost for operating and repair labor, maintenance materials, utilities, and 10-year depreciation charges. Estimates general overhead from 3.5 to 4.0 cents per pound. For the oxidation process the plant investment is estimated to be $400 per-ton-of-phenol-per-year capacity against $426 for the Durez unit that employs the chlorination process.

244. _____. Recent Process Advances Outstanding. Petrol. Eng., vol. 24, No. 7, July 1952, pp. C-3-6.

Briefly summarizes papers presented at the 17th mid-year meeting of the American Petroleum Institute, Division of Refining, at San Francisco May 12-15, 1952. Includes brief summary of costs related to thermofor catalytic reforming, fluid hydroforming, electrolytic regeneration of spent caustic solutions, platforming - Udex, arosorb, and extractive distillation.

245. _____. Refining Construction Going Strong in 1953-54. Petrol. Eng., vol. 26, No. 4, April 1954, pp. C-39-41, 44-46, 48, 50.

Presents a roster of refining, natural gasoline, and petrochemical plants started or completed between January 1, 1953, and March 1, 1954. This article is indexed only for those products for which both plant capacity and investment costs are given.

246. _____. Status of Synthetic Fuels. Petrol. Eng., vol. 24, No. 10, September 1952, pp. C-3-4.

Briefly summarizes the status of the synthetic liquid fuels situation. Briefly summarizes costs for investment, gasoline, Federal income tax, and return on investment.

247. FOX, E. D. Production of Ammonium Sulfate From Refinery Waste........ Oil Gas Jour., vol. 51, No. 22, Oct. 6, 1952, pp. 113-115, 117.

Describes production of ammonium sulfate from waste acid sludge and ammonia. Says that utility cost is nominal and gives raw material and ammonium sulfate costs.

248. FRITTS, H. W. Aluminum Alloys. Ind. Eng. Chem., vol. 45, No. 10, October 1953, pp. 2175-2182.

The article reviews the uses of aluminum alloys as chemical engineering materials of construction. Says that switching from copper to aluminum heat-exchanger tubes and fittings saved about $7,000 per unit.

249. GARNER, L. W. Accounting for Factory Overhead Expenses in a Multiple-Use Plant. Ind. Eng. Chem., vol. 44, No. 12, December 1952, pp. 2829-2832.

Contains no actual costs but gives definitions of several terms used in estimating and explains the accounting procedure at the main plant of J. T. Baker Chemical Co.

250. GILBERT, NATHAN, HOBBS, I. A., and LEVINE, J. D. Pilot Plants: Hydrolysis of Wood Using Dilute Sulfuric Acid. Ind. Eng. Chem., vol. 44, No. 7, July 1952, pp. 1712-1720.

"Describes the pilot plant built at Wilson Dam and the experimental work, the results of which were used to formulate a modification of the Madison wood sugar process that is believed to be economically preferable because it (1) uses somewhat simpler equipment and (2) produces solutions of higher concentration. Results of cost estimates made to gage the economic feasibility of this method for the utilization of nontimber grades of wood and of waste from woodworking industries are presented also."

251. GILMORE, J. F., JR. Short Cut Estimating of Processes........ Petrol. Refiner, vol. 32, No. 10, October 1953, pp. 97-101.

The author presents the method and data from his own files for preparing "quick" cost estimates of process units. Gives detailed description of the method. Estimates the cost of constructing a catalytic reforming unit to illustrate the method. Gives a table showing a breakdown of investment and operating costs for a crude vacuum-distillation unit, gas plant, catalytic reforming unit, catalytic cracking unit, hydrofluoric acid alkylation unit, catalytic polymerization unit, delayed coking unit with mechanical decoking, and a delayed coking unit with hydraulic decoking. Also see ref. 474.

252. GITZENDANNER, F. A. The Economics of Tank Failures........ Petrol. Refiner, vol. 33, No. 5, May 1954, pp. 160-162.

Discusses brittle failures of storage tanks and concludes that "there is no cause for extreme concern". Discusses costs for tank failure insurance. Gives investment costs for storage tanks of two sizes and loss figures for failures.

253. GONZALEZ, R. J. What's Ahead for Natural Gas?........ Oil Gas Jour., vol. 53, No. 1, May 10, 1954, pp. 124, 127-132.

Compares production, reserves, consumption, and market price statistics for coal, oil, and natural gas, with particular emphasis on natural gas.

Gives consumer price index for major fuels for a number of years. Breaks down natural gas prices into areas and into residential, commercial, field use, carbon black, etc. classes.

254. **GORDON, JOSEPH.** Wanted: Chlorine Without Caustic........ Chem. Eng., vol. 60, No. 5, May 1953, pp. 187-193.

Article is a technical and economic survey of the most important candidate processes for chlorine production other than those in which caustic is also produced. Gives operating costs from $25 to $35 per ton of chlorine output for plants that make from 35 to 50 tons of chlorine a day.

255. **GREEN, W. G.** How to Design and Operate Refinery Flares.... 2 - Venturi-Type Aspirating Burners. Oil Gas Jour., vol. 51, No. 13, Aug. 4, 1952, pp. 75-76.

This is the second in a series of four papers, by different authors, on refinery flares. The other three articles contained no cost information. This article gives a cost of $63,000 (1946 prices) for this particular installation, exclusive of the collecting system.

256. **GREENWALD, DOUGLAS.** This Month's Industry Trends. Equipment Costs. Chem. Eng., vol. 61, No. 3, March 1954, p. 358.

Gives Marshall and Stevens Indexes for the process industries and related industries. See refs. 93, 347, 348 for further explanation of these indexes and for indexes covering other periods.

257. **GRISDALE, R. W.** Portable Heater Used in Tank Cleaning at Rangely. Oil Gas Jour., vol. 51, No. 42, Feb. 23, 1953, pp. 190, 192.

Gives $1,900 as the cost for a small portable trailer-mounted unit consisting of direct-fired heater and recycle pump with engine.

258. **GRISWOLD, T. N., and THOEN, J. O.** Continental Cleans In-Place. Chemical Cleaning Is a Versatile Tool. Oil Gas Jour., vol. 51, No. 46, Mar. 23, 1953, pp. 236, 239-240, 242.

Discusses the chemical cleaning method and equipment employed at Continental Oil's Ponca City refinery. Gives cost comparison between hand and chemical cleaning of exchanger bundles.

259. **GROTE, H. W., WATKINS, C. H., POLL, H. F., and HENDRICKS, G. W.** New Data on Unifining........ Petrol. Refiner, vol. 33, No. 4, April 1954, pp. 165-170.

Discusses the unifining catalytic hydrogenation process for sulfur and nitrogen removal from a number of refinery stocks and results obtained with it. Gives investment and operating costs for two unifining units: The first is a 5,000-barrel-per-stream-day unit, including stabilizer and splitter, that charges a mixture of high-sulfur, cracked, and straight-run, 210°-500° F., naphthas to produce catalytic refining feed and fuel oil; and the second is a 5,000-barrel-per-stream-day unit, including steam stripper, that charges a 400°-650° F. straight-run fraction to produce diesel fuel.

260. _____. Unifining.... A New Petroleum Process........ Oil Gas Jour., vol. 52, No. 50, Apr. 19, 1954, pp. 211-216.

Includes essentially the same information as ref. 259.

261. GROVE, C. S., JR., VODONIK, JOSEPH, and CASEY, R. S. Fibers. Ind. Eng. Chem., vol. 45, No. 10, October 1953, pp. 2199-2204.

Summarizes the recent commercial developments in, and expansion of, synthetic fibers' production. Gives brief summary of plant investment costs.

262. GROVE, M. B. .... Here's How Interstate Lines Pipe in Place to Prevent Internal Corrosion. Oil Gas Jour., vol. 52, No. 37, Jan. 18, 1954, pp. 109-110.

Gives coating cost of 53.5 cents per foot for 6-inch pipe. Also includes cost of laying replacement pipe.

263. GUTHMANN, W. S., and INMAN, P. R. Cost Estimation in a Multipurpose Plant. Ind. Eng. Chem., vol. 44, No. 12, December 1952, pp. 2832-2833.

Article states that "Costs may be divided into the general classifications of raw materials, direct labor, other direct costs, and indirect expenses (overhead). In a multipurpose plant the principal difficulty lies in the allocation of indirect expenses. Only through a good cost accounting system can a method of estimating overhead be devised. For practical reasons, each company must choose the method of allocating overhead that will compromise accuracy and practicability. The choice of method will depend upon size of organization, type and number of processes, and management policies. Examples are given showing the effects of various methods of allocating indirect expenses." Discusses the cost items concerned and their relationship to each other.

264. GUTHRIE, V. B. Bureau Backed the Wrong Horse. Petrol. Proc., vol. 8, No. 3, March 1953, p. 440.

Comments on the Bureau of Mines work on coal hydrogenation. Includes brief summary of investment costs for Fischer-Tropsch processing and coal hydrogenation. Refers to the National Petroleum Council report.[17]

265. _____. Have You Organized Yet? Petrol. Proc., vol. 8, No. 12, December 1953, p. 1968.

Includes essentially the same cost information as ref. 421 on the cost of corrosion to refiners.

266. _____. The DuPont Story - Research........ Petrol. Proc., vol. 8, No. 1, January 1953, pp. 92-94.

Gives a brief history of DuPont's research activities and includes research expenditure figures for DuPont and a couple of petroleum companies. In 1951 DuPont spent, exclusive of money for new facilities, over 21 percent of its net income for research.

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[17] See footnote 10 (ref. 123).

267. GUTHRIE, V. B. ....Five Steps to Lower Corrosion Costs........ Petrol. Proc., vol. 9, No. 1, January 1954, pp. 72-74.

Discusses Shell Oil's Management Engineering Council's Corrosion Committee and its program for corrosion control.

268. _____. Man-Size Petrochemical Venture.... Petrol. Proc., vol. 9, No. 1, January 1954, pp. 83-85.

Contains the same cost information as ref. 131, although the two discussions are somewhat different.

269. _____. Measuring Plant Corrosion Costs........ Petrol. Proc., vol. 9, No. 5, May 1954, pp. 708-710.

Discusses a new technique, developed by the American Petroleum Institute, Refining Division's cost study group, for analyzing corrosion costs. Summarizes overall and per-barrel refining corrosion costs (1951), as follows:

Cost factor	Cost per bbl. of crude run	Total industry cost (approx.)
Anti-corrosion built in	$0.021	$50,000,000
Maintenance	.071	168,000,000
Lost production on scheduled shutdowns.	.018	43,000,000
Tool stocks, inventory	.0025	6,000,000
Total	$ .1125	$267,000,000

Also gives a report on tank failures, including some economics.

270. _____. Old Quarries for Oil Storage. Petrol. Proc., vol. 8, No. 8, August 1953, pp. 1168-1169.

Discusses possibilities of utilizing abandoned quarries for oil storage, taking into account the type of terrain and strata suitable for the purpose. Includes some investment costs for such storage.

271. HADER, R. N., WALLACE, R. D., and McKINNEY, R. W. Staff-Industry Collaborative Report: Formaldehyde From Methanol. Ind. Eng. Chem., vol. 44, No. 7, July 1952, pp. 1508-1518.

Presents a detailed description of formaldehyde production from methanol, as carried out at Spencer Chemical's plant at Calumet City, Ill. Briefly discusses plant-investment costs.

272. HALEY, H. E., McCLANAHAN, D. N., and STREET, J. P. A Critical Study of the Selling Price of Synthetic Rubber Plants........ Petrol. Refiner, vol. 32, No. 7, July 1953, pp. 113-117.

Presents an engineer's view point on the price the government should set on its synthetic rubber facilities, considering original investment, replacement cost, and raw material availability. Considers both investment and operating costs for several types of rubber plants.

273. HAMILTON, J. P. Economic Analysis in Petroleum Refining. Petrol. Refiner, vol. 32, No. 10, October 1953, pp. 102-106, 109.

Discusses and shows how to determine the dollar value of payouts on new installations, optimum operating methods, cost of new products, and new research projects. Also see ref. 474.

274. HARRIS, F. P. Pro & Con: Power Reactors. Chem. Eng., vol. 60, No. 7, July 1953, p. 146.

This is a letter from F. P. Harris to the editor commenting on the article by Walter Kidde engineers (ref. 98) in which it was claimed that the first power reactor might get underway within a year and that a 100,000 kw. plant would now cost only from $10 to $20 million. The editor answers this comment and refers to a forthcoming article on the subject (refs. 100-102).

275. HART, PORTER, and KING, R. C. Pressure Measurement and Control. Petrol. Refiner, vol. 31, No. 12, December 1952, pp. 107-110.

Discusses types and applications of pressure instruments and controls. Includes costs for some such instruments and controls.

276. HARTOGENSIS, A. M. Pro & Con: Pro: Depreciation Charges. Chem. Eng., vol. 61, No. 6, June 1954, pp. 410-413.

This is a letter from A. M. Hartogensis to the editor replying to F. L. Rubins previous letter to the editor (ref. 490).

277. HARTOGENSIS, A. M., and ALLEN, H. D. Evaluate Your Depreciation Charges........ Chem. Eng., vol. 61, No. 2, February 1954, pp. 195-198.

Presents basic background information on depreciation, deterioration, and obsolescence. Defines these items, what they constitute, their interrelationship, and how to determine depreciation. A table lists useful lives (approved for income tax calculations) for a considerable number of equipment items that are arranged according to processing industries in which they are used.

278. HARVEY, C. C. Economic Factors of: Atmospheric Corrosion Versus Protection .... Petrol. Refiner, vol. 32, No. 6, June 1953, pp. 122-124.

Analyzes the following economic aspects of painting programs: (1) Will protective coatings pay out?; (2) Does the decorative function have a cash value?; and (3) Should you repaint before or after original coat fails? Article presents a series of curves, showing cost of atmospheric corrosion allowance, and gives per-square-foot paint and painting costs.

279. HAUSERMAN, M. F., JR. Refining Pointers: Low-Cost Insulation Has Quick Payout. Oil Gas Jour., vol. 53, No. 8, June 28, 1954, p. 121.

Describes a new method of insulating heavy-stock storage tanks with a galvanized metal exterior. Gives $1.05 per square foot as cost for applying insulation.

280. HAVERFIELD, F. B. Steam Centrifugal Compressors. Petrol. Eng., vol. 24, No. 8, Reference Annual 1952, pp. D-35-36.

Discusses the first steam turbine-driven compressors used by the gas industry. Briefly compares operating costs for a station using steam turbines and for one using reciprocating engines.

281. **HAYES, C. W.** Low Temperature Gasoline Plants........ Petrol. Eng., vol. 24, No. 8, Reference Annual 1952, pp. C-41-46.

Discusses, in detail, gas processing as it might apply to a lease operation. Shows in tabular form the income possible by using various combinations of separation methods applied to high-pressure and low-pressure gases. Also includes estimated plant investment costs and payout times for such plants.

282. **HAYS, H. L., and BARBER, F. T.** Composition and Quantity of Feed Gas Are Major Factors Affecting Profitably of Sulfur Recovery from H_2S. Oil Gas Jour., vol. 52, No. 51, Apr. 26, 1954, pp. 218, 221-222, 225.

Discusses Phillips Chemical's modified Claus process for sulfur recovery from hydrogen sulfide. Contains investment and operating costs for plants of various capacities and using varied feed gas compositions.

283. **HETHERINGTON, GEORGE, and McDOWELL, J. M.** Determining Most Profitable Method of Exploiting Gas-Condensate Reservoirs........ Petrol. Eng., vol. 25, No. 12, November 1953, pp. B-107-108, 110-112, 114-116, 118-120.

Gives a detailed discussion of several methods for exploiting gas-condensate reservoirs. Includes a table showing comparative economics of dew point cycling, cycling at 3,400 p.s.i., cycling at 500 p.s.i., and pressure depletion.

284. **HIRSCH, C. E.** How Hanford Evaporates Fission Wastes. Chem. Eng., vol. 60, No. 11, November 1953, pp. 184-185.

Describes the revised waste fission product storage method developed at the Hanford AEC installation. Gives underground storage tank cost of 37 cents per gallon of stored waste and gives $443,000 as the savings in storage space accomplished during first 8 months of operating under the new system.

285. **HOERSCH, ALBERT, JR.** Clad Steel in Petroleum Equipment. Petrol. Proc., vol. 8, No. 5, May 1953, pp. 700-703.

Discusses six cases when clad steel should or should not be used in petroleum equipment. Contains numerous tables of data pertaining to welding and fabrication, properties of clad steel, thermal conductivity of materials, etc. A series of curves shows fabrication costs by circumferential seam welding compared with extra costs (the difference in costs between standard width plate and the widest plate available for the job) for 10 percent clad steel. Gives cost per square foot for a 1-inch steel cracking vessel and 7/8-inch column. Gives costs of providing clad protection to a crude distillation unit and resulting savings made in maintenance costs.

286. **HOOG, H., KLINKERT, H. G., and SCHAAFSMA, A.** Hydrodesulfurization........ Oil Gas Jour., vol. 52, No. 5, June 8, 1953, pp. 92, 94-96.

Discusses Shell's hydrodesulfurization process for upgrading high-sulfur stocks. Includes investment and operating costs for 10,000-barrel-per-day gas oil and cracked cycle oil operations. Contains the same cost information as ref. 287 but less test data.

287. HOOG, H., KLINKERT, H. G., and SCHAAFSMA, A. New Shell Hydrodesulfurization Process Shows These Features........ Petrol. Refiner, vol. 32, No. 5, May 1953, pp. 137-141.

Contains the same cost information as ref. 286 but more test data.

288. HORN, A. B., SERGEYS, F. J., and STRADER, W. C. Economic Analysis in Chemical Plants........ Petrol. Refiner, vol. 32, No. 10, October 1953, pp. 107-109.

Analyzes the methods employed by economic analysis specialists in guiding a new product from conception to marketing. Lists, then describes, the purposes of economic evaluations; important cost elements; and manufacturing cost items. Also see ref. 474.

289. HORNADAY, G. F. Take Another Look at the Houdry Dehydrogenation Process. Petrol. Refiner, vol. 32, No. 9, September 1953, pp. 130-131, 134.

Discusses Houdry's process for dehydrogenating butane, or a butane-butene mixture, to butadiene. Shows the effect of butane price and of fuel and steam costs on butadiene cost. Lists utility prices. Shows economics of Houdry butane dehydrogenation to produce 26,500 tons of butadiene per year.

290. HULBERT, C. C., and RIPPETOE, J. A., JR. Organic Inhibitor Controls Refinery Corrosion. Oil Gas Jour., vol. 52, No. 15, Aug. 17, 1953, pp. 120-122, 124, 126-127.

Discusses results of 2 years experience with an organic corrosion inhibitor in a crude-oil fractionating unit. Gives an inhibitor cost of about 1.3 mills per barrel of crude processed; the savings in ammonia cost are estimated to be 0.3 mills per barrel of crude. Contains the same cost information as ref. 291 but a somewhat different discussion.

291. _____. Reduce Corrosion Costs With Organic Inhibitors........ Petrol. Refiner, vol. 32, No. 6, June 1953, pp. 113-118.

Contains the same cost information as ref. 290 but a somewhat different discussion.

292. HULL, D. E., and BOWLES, R. R. New Use for Radioactive Tracers.... Measuring Catalyst Flow Rates in Cat Crackers. Oil Gas Jour., vol. 51, No. 46, Mar. 23, 1953, pp. 295-296, 299.

Describes the method, devised by Standard Oil of California, that uses radioactive tracers to study catalyst flow rates in catalytic cracking units. Claims a $100,000 shutdown was averted by using this technique.

293. HUMPHREYS, R. L. New Process. Cyclic Adsorption Refining........ Petrol. Refiner, vol. 32, No. 9, September 1953, pp. 99-101.

Discusses California Research's cyclic adsorption process for recovery of aromatics from reformates (claims yields of 99 percent are possible) and for removal of aromatics to produce high-grade kerosene raffinates. Gives capital costs per barrel of charge capacity for three sizes of plants for each of these operations.

294. INDUSTRIAL AND ENGINEERING CHEMISTRY. I.&E.C. Reports on Chemical Progress in 1953: Construction Costs. Vol. 46, No. 1, January 1954, pp. 27A-31A.

Discusses, in a general way, the 1953 construction picture from the labor and material standpoints. Refers to Bureau of Labor Statistics' cost figures for building materials in 1953 compared to those for 1952 and compares Commerce Department's Composite Index figures on construction costs for August 1953 against 1947-49 values.

295. INSKEEP, G. C., TAYLOR, G. G., and BREITZKE, W. C. Lactic Acid From Corn Sugar. Ind. Eng. Chem., vol. 44, No. 9, September 1952, pp. 1955-1966.

This is a staff-industry report on operations of the American Maize's plant that produces lactic acid from corn sugar. Includes a breakdown of production costs at the plant.

296. JACKSON, W. K., CHADD, C. K., and KRAUSSE, D. M. The Economics of Making High Purity Aromatics. Petrol. Proc., vol. 9, No. 2, February 1954, pp. 233-237.

Contains operating data, product characteristics, and operating costs for the platformer-Udex plant (emphasis on the Udex operation) at the Cosden Petroleum refinery Big Spring, Tex.

297. JELEN, F. C. Next Time Use Capitalized Costs........ Chem. Eng., vol. 61, No. 2, February 1954, pp. 199-203.

The purpose of the article "is to develop certain mathematical relationships involved in the cost factors so that a comparison of various alternatives (materials or methods in design or operation of a chemical plant) will be on a sound economic basis". Illustrates these mathematical relationships. See also refs. 298 and 490.

298. _____. Pro & Con: Pro: Capitalized Costs. Chem. Eng., vol. 61, No. 6, June 1954, pp. 409-410.

This is a letter by F. C. Jelen to the editor in reply to the letter by F. L. Rubin (ref. 490) to the editor in which Mr. Rubin disagreed with some points presented by Mr. Jelen in his article on capitalized costs (ref. 297).

299. JOHNSON, W. A. Economics of Cathodic Protection. Petrol. Eng., vol. 26, No. 5, May 1954, pp. D-18-19.

Discusses application of cathodic protection to reduce pipeline corrosion. Includes tabulated data that compares costs of leaks with costs of cathodic protection.

300. JONES, E. L., PARKER, F. D., and STROBEL, W. B. Increase Profits With Petrochemicals From Refinery Coke........ Petrol. Refiner, vol. 33, No. 4, April 1954, pp. 175-179.

Discusses increased profits from coking; conversion of coke to acetylene; advantages of coke-derived acetylene; and petrochemical products from acetylene. Includes considerable investment and operating cost data related to the above topics. Contains the same cost information as refs. 301 and 302 but somewhat more discussion than ref. 301.

301. JONES, E. L., PARKER, F. D., and STROBEL, W. B. Petrochemical Profits From Refinery Coke. Petrol. Proc., vol. 9, No. 5, May 1954, pp. 734-738.

Contains the same cost information as refs. 300 and 302 but somewhat less discussion.

302. _____. .... Realize a Profit From Refinery Coke. Oil Gas Jour., vol. 52, May 3, 1954, pp. 97-101.

Contains the same cost information as refs. 300 and 301 and the same discussion as ref. 300.

303. KELLY, E. J. Pro & Con: Ejector Costs. Chem. Eng., vol. 60, No. 3, March 1953, pp. 158, 160.

This is a letter, from E. J. Kelly to the editor, commenting on J. C. Tallman's article on ejector costs (ref. 533). Kelly makes some clarifying remarks.

304. KENNEDY, W. L., JR., and STUEVE, C. C. Here's a Short-Cut Method for Sizing Crude-Oil Pipe Lines. Oil Gas Jour., vol. 52, No. 20, Sept. 21, 1953, pp. 183-184, 188, 264.

Presents a method that permits a rapid and relatively easy means of determining the size of crude oil pipeline that will probably be the most economical for a given throughput. The authors caution that the data presented should not be used as a guide for measuring investment and transportation costs for any particular line. Gives cost of installed horsepower for centrifugal pumps.

305. KILGREN, E. W., and MILLER, C. S., JR. A Short Cut to Gasoline and Cycling-Plant Costs. Oil Gas Jour., vol. 51, No. 51, Apr. 27, 1953, pp. 144-152, 201.

Presents two short-cut methods for making preliminary cost estimates on proposed field-processing plant projects. Gives extensive investment and operating cost data for such plants.

306. KING, F. C., JR. Better Results With Fewer Men........ Oil Gas Jour., vol. 53, No. 8, June 28, 1954, pp. 101-104.

Discusses the long-range program of General Petroleum developed to control refinery maintenance costs through minimizing the number of maintenance employees on the weekly payroll. Contains essentially the same cost information as ref. 307 but somewhat less discussion.

307. _____. Minimize the Refinery Maintenance Crew........ Petrol. Refiner, vol. 33, No. 5, May 1954, pp. 183-188.

Contains essentially the same cost information as ref. 306 but somewhat more discussion.

308. KISTIN, H. R., CAMERON, C. S., and CARTER, A. P. Where Do Construction Dollars Go? Chem. Eng., vol. 60, No. 11, November 1953, pp. 191-195.

Presents a detailed analysis of construction expenditures for chemical plants built during World War II. Gives a breakdown of equipment expenditures according to type. Shows installed equipment cost per unit of productive capacity and nonequipment costs for new plants and balanced additions for approximately 70 products and processes; percentage distribution of equipment expenditures for about 50 products and processes; and comparison of cost distribution for new plants versus balanced additions.

309. **KRYSTOW, P. E.** How to Evaluate Economy of Construction Materials. Chem. Eng., vol. 60, No. 1, January 1953, p. 204.

Discusses the use of corrosion data for determining the most economical type of construction material to use for a job. The lowest cost per year is the important factor, and the material with the lowest corrosion rate does not necessarily give this value.

310. **KUHASZ, C. J.** "Pre-Fabs" Permit Good Savings in Structural Fireproofing. Petrol. Proc., vol. 7, No. 11, November 1952, pp. 1616-1619.

Discusses a new method for fireproofing structures by using shop-fabricated light concrete sections. Estimates costs are from 25 to 50 percent less than conventional methods. Gives an actual case history that includes cost data.

311. **KUHASZ, C. J., and SHUMAN, E. C.** New Procedures in Industrial Thermal-Insulation Application. Oil Gas Jour., vol. 51, No. 26, Nov. 3, 1952, pp. 90-98.

Presents a discussion of new methods, materials, and concepts pertaining to high-temperature refinery insulation. Gives brief summary of cost savings actually realized by the new over the old methods.

312. **LANDAU, RALPH.** Two Questions About Ethylene Oxide by Direct Oxidation........ Petrol. Refiner, vol. 32, No. 9, September 1953, pp. 146-147, 150-151.

Compares production of ethylene oxide by direct oxidation and via ethylene chlorohydrin. Also discusses the merits of the fixed-bed and fluid-bed techniques. Estimates cost of producing 1 pound of ethylene oxide by direct oxidation to be 3 cents less than by the chlorohydrin route. Comments also on the savings in raw material costs possible with the direct oxidation process.

313. **LANE, J. A., and McLAIN, STUART.** The Design of Nuclear Power Plants. Chem. Eng. Prog., vol. 49, No. 6, June 1953, pp. 287-293.

Discusses the design and operation of nuclear reactors for use as power plants. Gives investment costs for component parts of nuclear reactors and comparative investment and power costs for coal-fired and nuclear steam power plants.

314. **LANG, H. J.** Pro & Con: Manhours Per Square Foot. Chem. Eng., vol. 60, No. 4, April 1953, pp. 156, 158.

This is a letter by H. J. Lang to the editor discussing J. P. O'Donnell's article on correlating engineering and other indirect project costs (ref. 390).

315. LaPOINTE, J. R. Freight Costs for Equipment Shown by Nomograph. Chem. Eng., vol. 60, No. 4, April 1953, p. 213.

Gives a nomograph with explanations on its use that permits determination of both unit and total freight costs for Eastern areas or for transcontinental routes.

316. LAPPLE, C. E. Elements of Dust and Mist Collection. Chem. Eng. Prog., vol. 50, No. 6, June 1954, pp. 283-287.

Defines the basic consideration to be met by any dust- or mist-collecting system now available or to be developed. Gives brief summary of costs of collection equipment and air-conditioning equipment.

317. LAULHERE, B. M., JR. Gathering System Construction Cost........ Petrol. Eng., vol. 25, No. 8, Reference Annual 1953, pp. D-12, 14, 16, 18.

Gives a comparison between buried and surface lines on an assumed ideal pipeline. Includes construction costs for the two types.

318. LAWRENCE, J. C. Costs. Process and Construction........ Part 1. Ind. Eng. Chem., vol. 46, No. 2, February 1954, pp. 73A-74A, 76A; Part 2. Ind. Eng. Chem., vol. 46, No. 4, April 1954, pp. 81A-83A; Part 3. Ind. Eng. Chem., vol. 46, No. 6, June 1954, pp. 77A-78A, 80A.

Part 1 discusses the importance of evaluating each phase of a process and comparing alternatives in order to reduce product costs. Describes a technical evaluation team and its operation. Shows the effect of investment on "mill cost" of the product. Part 2 discusses depreciation, maintenance, and return as they affect "mill costs". Part 3 discusses how "controllable items in a cost sheet may point the way to reduced process costs".

319. LEDEEN, HYMAN, and TOBEN, A. A. Power Operation of Valves........ Petrol. Eng., vol. 25, No. 11, October 1953, pp. A-62, 67-68, 70, 72, 74, 77-78.

Discusses the operation and advantages of and equipment used in power operation of valves. Estimates the savings in manpower effected by installing such valves. Gives costs for actuators installed on valves, for compressors for operating the actuators, and for hydraulic pumping units.

320. LEE D. C., JR. .... 2. Perforated Plates........ Oil Gas Jour., vol. 52, No. 51, Apr. 26, 1954, pp. 155-158.

This is the second article of a symposium on fractionating-absorption tray design. This article describes the design and operation of the perforated plate for distillation columns. Estimates this type costs only from 25 to 50 percent as much as bubble plates.

321. _____. Perforated Plate Distillation Columns. Petrol. Eng., vol. 26, No. 5, May 1954, pp. C-21-23, 26.

Contains essentially the same information as refs. 320 and 322.

322. _____. Sieve Trays. Chem. Eng., vol. 61, No. 5, May 1954, pp. 179-182.

Contains essentially the same information as refs. 320 and 321.

323. LEE, J. A. Cheap Way to Remove Fluorides From Water. Chem. Eng., vol. 59, No. 7, July 1952, pp. 211, 400-401.

Gives $10,000 as the investment cost for a plant that can reduce fluoride concentration from 8 to 1 p.p.m. at the rate of 450 gallons of water per minute. Plant uses activated alumina to remove the fluorides, and the alumina is reactivated by alkali and acid washes.

324. LEONARD, J. D. You Can Cut Maintenance Costs........ Chem. Eng., vol. 61, No. 2, February 1954, pp. 206-208.

Discusses some of the most common obstacles in the path of better maintenance operations and suggests what can be done to overcome them. Costs related to the subject are given in general terms.

325. LEWIS, G. E. Your Guide to Mixer Costs. Chem. Eng., vol. 60, No. 1, January 1953, pp. 191-194.

Presents installed costs and horsepower requirements for mixers, for a number of applications, classified for use with liquids, solids, or semisolids and as miscellaneous types. See ref. 491.

326. LEWIS, O. L. Design of Gasoline Plants, Part 6. Selection of Pipe Fittings. Petrol. Eng., vol. 24, No. 7, July 1952, pp. C-34-36, 38.

This is the sixth in a series of articles related to the design of gasoline plants. The other articles contained no cost information. This article discusses how to select the proper pipe fittings. Includes several graphs that show costs of various fittings for a range of pipe sizes.

327. LINDSEY, ERNEST. Evaporation........ Chem. Eng., vol. 60, No. 4, April 1953, pp. 227-240.

The article was designed to cover the subject of evaporators in such a manner that one can define his particular problem and evaluate recommendations received from manufacturers. Covers both new and standard types of equipment and reviews energy-saving methods. Includes some equipment cost information.

328. LINZ, B. F. 1953 Wages - 1948 Prices, Costs Continue to Soar; Price Tags Unchanged........ Oil Gas Jour., vol. 51, No. 38, Jan. 26, 1953, pp. 285-286.

Contains indexes for petroleum prices, oil- and gas-production wages, and refinery wages. Gives price indexes for petroleum and petroleum products, iron and steel, and farm products. Also covers wages, earnings, etc. All the above indexes cover the period from 1947 to 1952, and the interrelationships of the various items are discussed.

329. _____. Radioisotopes.... A New and Important Tool in All Phases of Industry. Oil Gas Jour., vol. 52, No. 19, Sept. 14, 1953, pp. 106, 108, 139.

Discusses briefly several industrial applications of radioisotopes in the petroleum industry. Gives one example that shows actual cost savings made by using this technique.

330. LINZ, B. F. Synthetics Plant Urged........ Oil Gas Jour., vol. 51, No. 14, Aug. 11, 1952, p. 79.

Summarizes the report, made by O. L. Chapman, Secretary of the Interior, to Congress, explaining that the "time is ripe for private companies to begin making liquid fuels from shale oil". Includes a brief summary of investment costs for a thermal refining project and a hydrogenation project; both projects based on 250,000 barrels of shale oil per day.

331. _____. Synthetics Still Costly........ Oil Gas Jour., vol. 51, No. 43, Mar. 2, 1953, pp. 42-43.

Includes comments and a summary of synthetic liquid-fuels production costs, in table form, for Fischer-Tropsch, coal hydrogenation, and oil shale processing on various scales. Comments that an industry committee has reported to the National Petroleum Council that oil shale is oil's closest competitor, but gasoline would cost 14.7 cents per gallon at the refinery.

332. _____. Will We Mine Oil? Oil Gas Jour., vol. 52, No. 33, Dec. 21, 1953, pp. 106-107.

Discusses comments and attitudes of various government and industry members concerning the necessity for developing a synthetic fuels industry. Gives the investment figures, estimated by A. C. Rubel of Union Oil, for two shale-oil operations.

333. LOOFBOUROW, R. L. Excavating Underground LPG Storage........ Petrol. Eng., vol. 24, No. 8, Reference Annual 1952, pp. C-48-49.

Summarizes an engineer's experiences in digging one underground-storage unit. Gives general factors that cause cost variations. Estimates investment cost for underground storage at from $2 to $8 for unlined storage units ranging from 200,000- down to 50,000-barrel capacities.

334. LUDKA, W. R. Readers Views & Comments. Statistics: Figure or Range? Chem. Eng., vol. 59, No. 10, October 1952, p. 254.

This is a letter by W. R. Ludka to the editor commenting on P. Ferencz's article on statistics related to cost estimating.18/ Comments are concerned with the relationship between probable costs and standard deviation.

335. LUMMUS COMPANY. Rundown on the Shell Process for Manufacturing Ethylene Oxide and Ethylene Glycol........ Petrol. Refiner, vol. 32, No. 9, September 1953, pp. 154-155, 158.

Presents a summary of investment and operating costs for producing ethylene oxide and ethylene glycol by the Shell process.

336. LYNN, LAWRENCE. Make the Most of Capital Ratios........ Chem. Eng., vol. 61, No. 4, April 1954, pp. 175-176.

18/ See footnote 15 (ref. 192).

Defines capital ratio and how it can be used for cost estimating. Lists capital ratios for a number of types of industry. Gives the following equation:

Plant cost = capital ratio X annual sales.

337. **LYNN, LAWRENCE, and McKLIVEEN, J. R.** Simplify Your Cost Estimates........ Chem. Eng., vol. 60, No. 4, April 1953, pp. 193-195.

Deals with the use of nomography as a tool in economic studies, such as cost estimating. Explains and illustrates by example - economics of ammonia production - that, by presenting the results in a few carefully planned nomographs, a large number of graphs and tables can be eliminated.

338. **McCABE, L. C.** Atmospheric Pollution. Part 1. Ind. Eng. Chem., vol. 44, No. 11, November 1952, pp. 123A-125A. Part 2. Ind. Eng. Chem., vol. 44, No. 12, December 1952, pp. 99A-100A, 102A.

Part 1 describes the construction and applications of the "DEP" curtain-type dust collector recently introduced into the United States, which can be used as a filter, dryer, cooler, or scrubber. Includes initial costs for envelope-screen collectors. Part 2 describes the new Hemeon automatic air filter and its operation. Gives $125 as the cost for these units.

339. **McCONE, ALAN.** Two Erection Practices Speed Refinery Completion........ Petrol. Refiner, vol. 32, No. 1, January 1953, pp. 114-115.

Discusses the use of a stairwell and elevator shaft as a guy derrick pedestal. Also discusses coordination of construction with materials-delivery schedule. Gives cost of foundation, erection charges, and rental or depreciation at from $50,000 to $65,000 for a derrick pedestal for a guy derrick to set up a 360 foot high houdriflow catalytic cracking unit. An additional $1,000 would be necessary to reinforce the structure.

340. **McCONOMY, H. F., and HUR, J. J.** Metals and Coatings to Combat Corrosion .... Petrol. Eng., vol. 24, No. 8, Reference Annual 1952, pp. C-28-30.

"The purpose of this paper is to evaluate the additional expenditures incurred for each of the alternate types of replacement material under consideration, and to compare these costs with those of the usual steel roof replacement in such a manner that the most economical method may be readily selected." Considers protective coatings, alloyed installations, and heavier gage steel plate. Contains considerable data on materials' fabrication and installation costs, as well as repair cost equations.

341. **McFADDIN, D. E.** Condensate Extraction by Refrigeration........ Oil Gas Jour., vol. 52, No. 39, Feb. 1, 1954, pp. 78-80, 82.

Discusses, and includes investment and operating costs for several methods for recovering liquid products from natural gas streams.

342. _____. From California Natural Gas.... Liquid Fractions by Refrigeration .... Petrol. Refiner, vol. 33, No. 1, January 1954, pp. 162-164.

Contains essentially the same information as ref. 341.

343. McROBERTS, E. S. Economics of Packaged Compressor Plants........ Petrol. Eng., vol. 25, No. 12, November 1953, pp. E-4, 6, 10, 12-13, 16.

Discusses the use of packaged compressor plants and the manner in which they can reduce installation and maintenance costs. Gives a cost estimate for a 3,300 hp. packaged compressor plant installation. Compares actual maintenance and operating costs for a permanent-type and a packaged-type installation.

344. _____. Natural-Gasoline Pointer, Packaged Compressor Plants........ Oil Gas Jour., vol. 52, No. 39, Feb. 1, 1954, pp. 81-82.

Discusses packaged heavy-duty, direct-connected, gas-engine-driven compressor plants. Gives no actual cost figures but compares, in relative terms, the costs of the portable-type unit with those for a stationary installation.

345. MAREK, L. F. Oxidation. Ind. Eng. Chem., vol. 45, No. 9, September 1953, pp. 2000-2011.

Summarizes the past 10 year's progress in chemical production that involved oxidation reactions. Gives $1 million as the investment cost for the oxygen unit, for an ammonia-urea plant, that will produce 200 tons of oxygen and 300 tons of nitrogen per day.

346. MARKOVITS, J. A., and HIRST, L. L. Two American Coal-to-Oil Demonstration Plants. Mines Mag. (Colorado), vol. 42, No. 11, November 1952, pp. 129-144.

Discusses the activities of the two coal-to-oil demonstration plants of the Federal Bureau of Mines at Louisiana, Mo. Compares the National Petroleum Council's[19/] and Ebasco's[20/] cost estimates for a coal-hydrogenation plant at Rock Springs, Wyo. Also includes a cost summary for a 15,000-barrel-per-day coal-hydrogenation plant in Northern Wyoming; this breaks down investment costs and compares the two cases, when hydrogen is produced from natural gas and when it is produced from "H.O.L.D." gasification.

347. MARSHALL and STEVENS. Equipment Costs Still Going Up. Chem. Eng., vol. 61, No. 3, March 1954, pp. 214-215.

Gives equipment cost indexes for several of the process and related industries. For indexes covering other periods and for further explanation of these indexes see refs. 93, 256, 348.

348. _____. Process Equipment Costs Are Becoming Stabilized. Chem. Eng., vol. 60, No. 3, March 1953, pp. 220-221.

Contains graphs and tables to show equipment cost indexes from 1913 to 1952 for several process and related industries. See refs. 93, 256, and 347 for further explanation of and additional periods covered by these cost indexes.

349. MARTIN, A. B. Resources for the Chemical Industry in the United States, Rocky Mountain States, Part I. Electric Power Availability. Ind. Eng. Chem., vol. 45, No. 11, November 1953, pp. 2467-2474.

[19/] See footnote 11 (ref. 123).

[20/] See footnote 5 (ref. 67).

Summarizes the availability of electric power in the Rocky Mountain States and includes electric power rates and facilities' investments for the several States involved.

350. MARTIN, H. Z., BARR, F. T., and KREBS, R. W. Progress Report: More on the Fluid Coking Process. Oil Gas Jour., vol. 53, No. 1, May 10, 1954, pp. 166, 169-171.

Gives a condensation of a paper, presented by the authors at the 1954 W.P.R.A. meeting in Los Angeles, that summarizes the progress made on the fluid coking process since the original article was published on the subject.21/ No costs were included in the original article, but this article contains both investment and operating cost data for fluid coking.

351. MATTIX, E. D. Liquid Level Measurement and Control. Petrol. Refiner, vol. 31, No. 12, December 1952, pp. 111-115.

Discusses types of instruments used for, and principles involved in, liquid-level measurement and control. Includes a table that lists comparative costs of various types of liquid level instruments.

352. MATTOZZI, M. Building Refinery Process Units - 3.... Scheduling Construction .... Oil Gas Jour., vol. 51, No. 48, Apr. 6, 1953, pp. 100, 102.

This article is the third in a series on building process units; the other articles contain no cost information. This article discusses the mechanics of outlining the construction phase, including projection of material requirements. Estimates 18,000 man-hours required to erect each $100,000 worth of material based on 1946 costs rated at 100 in the refinery construction cost index.

353. MAYER, K. M. Joint Operation of Multiunit Complexes for Minimum Cost. Ind. Eng. Chem., vol. 46, No. 6, June 1954, pp. 1247-1255.

"The purpose of the article is to aid individual production supervisors, once assigned production quotas, to determine that they are obtaining the desired output from process, pot lines, mills, or plants at minimum cost to their companies." Includes 17 graphs that deal with production costs, marginal costs, breakeven point, etc. for single plants and for multiplant complexes.

354. _____. Operate for Maximum Profit. Chem. Eng., vol. 60, No. 9, September 1953, pp. 214-216.

Stresses the importance of designing for maximum profit within the company as a whole rather than for minimum unit cost of a product or for maximum profit within a plant or department of the company. Includes several graphs to illustrate the author's point.

355. MAYLAND, B. J., COMLEY, E. A., and REYNOLDS, J. C. Ammonia Synthesis Gas .... Chem. Eng. Prog., vol. 50, No. 4, April 1954, pp. 177-181.

21/ Voorhies, A., Jr., and Martin, H. Z., Fluid Coking of Residua: Oil Gas Jour., vol. 52, No. 28, Nov. 16, 1953, pp. 204-207.

Evaluates processes using natural gas as the raw material for ammonia manufacture. Gives investment costs for components of the plant and an operating cost breakdown.

356. MAYO, H. C. For FCCU, an Economic Comparison - Electric Motors Vs. Steam Turbines........ Petrol. Refiner, vol. 32, No. 8, August 1953, pp. 96-100.

Presents an extensive cost comparison between electric motors and steam turbines as drives for fluid catalytic cracking units.

357. _____. Steam Turbine Vs. Electric Drive for the Cat Cracker Blower........ Oil Gas Jour., vol. 52, No. 18, Sept. 7, 1953, pp. 86-88, 119.

Contains essentially the same information as ref. 356.

358. MEADE, L. P., and JENNINGS, C. P. ....Trifuel Pipe-Line Engines Demonstrate Operating and Economic Advantages........ Oil Gas Jour., vol. 52, No. 27, Nov. 9, 1953, pp. 112, 114, 150.

Describes a large company's experiences with four-cycle engines capable of burning diesel oil, natural gas with pilot oil, or, with minor conversions, natural gas. Also compares operating costs for straight gas operation, dual-fuel operation, and straight diesel operation.

359. MEKLER, VALENTINE, SCHUTTE, A. H., and WHIPPLE, T. T. Continuous-Coking Process Shows Ability to Handle Heavy Feed Stocks. Oil Gas Jour., vol. 52, No. 28, Nov. 16, 1953, pp. 200-203.

Describes the Lummus Co. first commercial continuous contact coking process. Gives operational data and compares the economics of contact and delayed coking processes.

360. _____. A Performance Report.... The Lummus Continuous Contact Coking Process .... Petrol. Refiner, vol. 32, No. 12, December 1953, pp. 131-134.

Contains essentially the same information as ref. 359.

361. MENARD, H., and BLOSSOM, E. D. Savings in Costs Indicated When Employing Latent Cooling of Compressors........ Oil Gas Jour., vol. 52, No. 51, Apr. 26, 1954, pp. 231-236.

Discusses various types of compressor cooling systems. Contains no actual cost figures, but makes some general statements about costs. Gives a comparison of factors that influence costs of installation and operation of conventional and latent cooling systems.

362. MERCER, R. S. Pro & Con: Pro: Protective Coatings. Chem. Eng., vol. 60, No. 6, June 1953, pp. 159-160.

This is a letter, by R. S. Mercer to the editor, commenting on the series of articles on protective coatings (ref. 534).

363. MILLER, S. A. Filtration. Ind. Eng. Chem., vol. 46, No. 1, January 1954, pp. 100-105.

Discusses theory, experimental data, design of methods, equipment, process applications, etc. for filtration. Gives a cost from $5 to $7 per square foot for ceramic plate under drains in water filters.

364. **MONTROSS**, C. F. Entrainment Separation........ Chem. Eng., vol. 60, No. 10, October 1953, pp. 213-236.

Presents results of a comprehensive survey of types, design, and performance of liquid entrainment separators. Lists first costs for the various types of entrainment separators.

365. **MOORE**, B. L. Higher Voltages Cut Electric Distribution Costs. World Oil, vol. 135, No. 3, August 1952, pp. 209-210, 215-216, 218, 220.

Discusses design and economics of electric distribution systems for well pumping. Includes costs of cables, motors, controls, switches, lightning arresters, and transportation.

366. **MOORE**, O. H. Research Vital Part of T.G.T. Operation........ Oil Gas Jour., vol. 53, No. 1, May 10, 1954, pp. 104-105, 120-131.

Discusses Tennessee Gas Transmission's applied research related to its high-pressure, multiple-pipeline gas-transmission system from the Mexican border to the New England seaboard. Gives installation costs for equipment to cool scavenger air. Also gives savings achieved by converting to high-compression engines.

367. **MORROW**, M. R., and **SHEWELL**, C. T. Effect of Multitesting on Refinery Production Costs. Ind. Eng. Chem., vol. 45, No. 1, January 1953, pp. 240-246.

Points out that specifications can be met either by replicate testing or by making the production so good that it cannot possibly fail - both of these methods cost money. Discusses the factors affecting the application of multitesting to approach the optimum point between the above two methods in order to reduce refinery production costs. Presents data and examples to illustrate the method.

368. **MURDOCK**, H. R. Industrial Wastes........ Part 1. Ind. Eng. Chem., vol. 45, No. 6, June 1953, pp. 103A-105A. Part 2. Ind. Eng. Chem., vol. 45, No. 8 August 1953, pp. 101A-103A.

Part 1 relates how one packing plant was able to profitably handle its waste disposal by evaporating only solutions capable of producing enough dry solids to offset costs, while the weaker waste solutions were biologically treated with sewage. Includes a chart from which the net cost of evaporation can be determined. Part 2 discusses disposal of process plant wastes in the ground by sprinkling or ridge-and-furrow methods.

369. **MURPHY**, L. J. Eliminate Compressor Operating Problems........ Petrol. Refiner, vol. 32, No. 4, April 1953, pp. 173-175.

Article was written to give answers to some troublesome problems related to operating compressors. Gives investment costs from $20 to $30 per cubic-foot-per-minute installed capacity for compressed-air plants and estimates cost of air at 5 cents per 1,000 cubic feet. Shows savings possible by increasing the air pressure in the pipe shop. Also includes a table that shows costs of air line leaks.

370. MURPHY, L. J. How to Design Compressor Accessories........ Petrol. Refiner, vol. 32, No. 3, March 1953, pp. 137-140.

Discusses design and operating data of filters, piping, intercoolers, and aftercoolers used in conjunction with compressors.

371. _____. How to Select Compressors........ Petrol. Refiner, vol. 32, No. 2, February 1953, pp. 115-118.

Presents data and other information, including costs, that provide a basis for choosing the proper type and size compressor for a particular job.

372. MUSTAKAS, G. C., SLOTTER, R. L., and ZIPF, R. L. Potassium Acid Saccharate by Nitric Acid Oxidation of Dextrose. Ind. Eng. Chem., vol. 46, No. 3, March 1954, pp. 427-434.

"Describes experiments in which potassium acid saccharate was produced by an improved process on a pilot-plant scale. The work was undertaken to develop operating conditions suitable for commercial-scale operations. A proposed plant process and cost estimates are based on engineering data obtained in the pilot plant."

373. MYLIUS, B. H. Gulf Coast Water Cooling.... Notes on Design, Maintenance, Operation of Cit-Con's Cooling Tower. Oil Gas Jour., vol. 52, No. 7, June 22, 1953, pp. 298, 300, 306.

Discusses Cit-Con's forced-draft cooling tower. Estimates monthly saving of $4,500 could be realized by operating unit at optimum outlet temperature.

374. NATHO, P. J. Gulf Coast Offshore Installation Boasts Model Low-Temperature Separation Unit. Oil Gas Jour., vol. 52, No. 31, Dec. 7, 1953, pp. 126-127.

Briefly discusses this low-temperature separation unit and its operation. States that the 28 percent increase of condensate production over conventional separation adds $110 per day additional revenue at a gas-delivery rate of 10 million cubic feet per day.

375. NELSON, W. L. Cost-Imating. Oil Gas Jour.

This is a series of cost estimating articles appearing in the Oil and Gas Journal in Jan., Apr., July, and Oct. issues of each year (usually the first issue of the month). They show current cost indexes for equipment, plants, and associated items.

Ref. No.	Title	Vol.	No.	Date	Page
375-1	New Items to Appear in Quarterly Cost Indexes	51	9	July 7, 1952	105-106
375-2	Material Prices Faltering - Wages Increasing	51	22	Oct. 6, 1952	137
375-3	Wages Increasing Steadily - Material Prices Steady	51	35	Jan. 5, 1953	87
375-4	Construction Costs Continued to Rise During 1952	51	48	Apr. 6, 1953	127
375-5	Material and Labor Costs Are Being Stabilized	52	9	July 6, 1953	109
375-6	Refinery Construction Costs Increase Slightly	52	22	Oct. 5, 1953	295
375-7	Costs Stabilizing or Declining	52	35	Jan. 4, 1954	99
375-8	Labor and Material Costs Moving Into Balance	52	48	Apr. 5, 1954	132

376. NELSON, W. L. Nelson Refinery Construction Index. Oil Gas Jour.

A series of articles appearing monthly in the Oil and Gas Journal (usually the first issue of each month). Included are cost indexes for pumps, compressors, etc.; electrical machinery; internal combustion engines; instruments; heat exchangers; miscellaneous equipment average; materials component; labor component; and refinery construction.

Ref. No.	Vol.	No.	Date	Page
376-1	51	9	July 7, 1952	123
376-2	51	13	Aug. 4, 1952	129
376-3	51	17	Sept. 1, 1952	131
376-4	51	22	Oct. 6, 1952	165
376-5	51	26	Nov. 3, 1952	148
376-6	51	30	Dec. 1, 1952	169
376-7	51	35	Jan. 5, 1953	103
376-8	51	39	Feb. 2, 1953	119
376-9	51	44	Mar. 9, 1953	143
376-10	51	48	Apr. 6, 1953	157
376-11	51	52	May 4, 1953	176
376-12	52	4	June 1, 1953	137
376-13	52	9	July 6, 1953	128
376-14	52	13	Aug. 3, 1953	127
376-15	52	18	Sept. 7, 1953	160
376-16	52	22	Oct. 5, 1953	322
376-17	52	26	Nov. 2, 1953	164
376-18	52	31	Dec. 7, 1953	163
376-19	52	35	Jan. 4, 1954	117
376-20	52	39	Feb. 1, 1954	112
376-21	52	43	Mar. 1, 1954	125
376-22	52	48	Apr. 5, 1954	152
376-23	52	52	May 3, 1954	124
376-24	53	5	June 7, 1954	133

377. _____. Progress in Metals. Part 1. Oil Gas Jour., vol. 52, No. 43, Mar. 1, 1954, p. 104. Part 2. Oil Gas Jour., vol. 53, No. 5, June 7, 1954, p. 121. Part 3. Oil Gas Jour., vol. 52, No. 7, June 22, 1953, p. 327.

Part 1 contains cost data, for several types of clad plate and clad linings for exchangers and storage tanks, as well as costs of type-410 stainless liners. These clad costs are compared with the costs of the solid material. Part 2 is concerned with low-alloy steels, primarily for high-strength services. Gives compositions of various alloys, and the table containing them includes relative costs of alloy bars compared to carbon steel bars. Part 3 lists prices of common metals, bright alloys, plastics, and alloy steels in various shapes and forms.

378. NELSON, W. L. Questions on Technology. Oil Gas Jour.

A series of articles appearing in the Oil and Gas Journal entitled "Questions on Technology", from which those including cost information are listed:

Ref. No.	Title	Vol.	No.	Date	Page
378-1	Early Construction Costs	51	20	Sept. 22, 1952	139
378-2	How Much Oil Equals a Ton of Coal?	51	33	Dec. 22, 1952	353
378-3	Cost of Coking Plants	51	37	Jan. 19, 1953	141
378-4	Penalty for "Sourness" in a Crude Oil	51	38	Jan. 26, 1953	403
378-5	Estimate of Price Changes of Alloy Steels	51	44	Mar. 9, 1953	126
378-6	Feasibility of Coking	51	46	Mar. 23, 1953	359
378-7	Cost of Handling and Firing Coal or Fuel Oil - 1	52	3	May 25, 1953	265
378-8	Cost of Handling and Firing Coal or Fuel Oil - 2	52	4	June 1, 1953	118
378-9	Summarizing - Cost of Handling and Firing Coal or Fuel Oil - 3	52	5	June 8, 1953	141-142
378-10	"Sour" Crudes Require Special Handling	52	5	June 8, 1953	142
378-11	What Price Complete Refinery Installation?	52	29	Nov. 23, 1953	117-118
378-12	What Price Oil Trucking?	52	37	Jan. 18, 1954	117-118
378-13	Effect of Improved Construction Techniques and Processing Methods on Cost Indexes	52	45	Mar. 15, 1954	157
378-14	Labor Component in Cost Index	52	46	Mar. 22, 1954	227
378-15	How Transportation Costs Compare	52	47	Mar. 29, 1954	132
378-16	What Price Lube-Oil Reclaiming?	52	51	Apr. 26, 1954	255

379. ______. What the Process Engineer Hopes to Find in the Accounting Records. Oil Gas Jour., vol. 51, No. 16, Aug. 25, 1952, pp. 123, 125, 129, 131-132, 134, 136.

Discusses how the engineer can use accounting records to advantage in making decisions regarding "changing the operating procedure of various refinery plants or units; changing the capacities of various units or the capacity of the entire refinery; producing new products or altering the relative amounts of the various products." Gives a chart that shows 1951 costs versus capacities for a number of complete refineries or plant units. Stresses the need for more detailed costs rather than total costs for making cost estimates. Gives comparative operating costs for small and large cracking plants and small and large topping and cracking plants.

380. **NEWBERG, A. H.** Crude-Oil Pipe Lining.... How Service Keeps 'Em Pumping. Oil Gas Jour., vol. 51, No. 12, July 28, 1952, pp. 381-386.

Presents a rundown of Service Pipe Line's and industry's accomplishments in expansion and modernization of pipelines. Includes investment costs for engines, speed reduction between engine and pumps, and an automatic pumping station.

381. **NIELSEN, R. F.** Engineering Fundamentals: Effect of Economic Factors on Pipe-Line Design. Oil Gas Jour., vol. 51, No. 31, Dec. 8, 1952, p. 127.

Gives calculations to illustrate how costs affect the basic design features of a gas pipeline.

382. **NOLAN, R. W.** Strain Gages........ Chem. Eng., vol. 60, No. 9, September 1953, pp. 217-228.

Presents a detailed discussion of the design and industrial application of resistance wire strain gages. Gives a brief summary of costs for auxiliary instruments.

383. **NOLL, H. D., BURTIS, T. A., and DART, J. C.** Houdriforming Economics - Effect of Feed Stocks, Boiling Range, and Reforming Severity........ Petrol. Eng., Reference Annual 1953, pp. C-15-16, 18.

Summarizes the results of a study of the effects of boiling range of the feed and reforming severity on the economics of reforming by the houdriforming process. Gives breakdown of investment and operating costs, as well as gasoline costs and earnings, for a number of different cases.

384. _____. How Feed Stock and Severity Affect Houdriforming Economics........ Petrol. Refiner, vol. 32, No. 5, May 1953, pp. 113-116.

Contains essentially the same information as ref. 383.

385. **NORTHRUP, D. H.** The A.E.C. or C.W.S. Air Filter. Chem. Eng. Prog., vol. 49, No. 10, October 1953, pp. 513-517.

Discusses development, design, and applications of the A.E.C. dry-type filter. Gives costs in general terms except for; "annual operating costs for a 10,000 cu. ft. per min. system generally run between $55 and $65 per 1,000 cu. ft. per min." Contains the same cost information as ref. 114 but a different discussion.

386. **NORTHUP, R. P.** Explosion-Proof Equipment Is Here to Stay........ Petrol. Refiner, vol. 32, No. 5, May 1953, pp. 123-126.

Gives practical hints on design, application, operation, and maintenance of explosion-proof equipment used to make a complete and safe electrical installation.

387. **NORTON, C. L., JR.** Refractories for Every Use........ Chem. Eng., vol. 60, No. 6, June 1953, pp. 216-220.

Discusses properties, types, applications, and costs of a number of refractories.

388. O'BRIEN, A. J., JR. Quotes, Extracts, and Digests: You Can Hold Down Costs .... Chem. Eng., vol. 60, No. 3, March 1953, pp. 336, 338.

Suggests three ways in which engineers can hold down construction costs but gives no actual costs.

389. O'CONNELL, J. F. Resources for the Chemical Industry in the United State, Rocky Mountain States, Part I. Plant Construction Factors. Ind. Eng. Chem., vol. 45, No. 11, November 1953, pp. 2474-2476.

Deals with availability, cost, and productivity of labor; labor relations; and availability and cost of raw materials in the Rocky Mountain States. Gives most costs in general terms but does show by means of a graph the average wage rates in building trades for July 1952 for various cities throughout the country.

390. O'DONNELL, J. P. New Correlation of Engineering and Other Indirect Project Costs. Chem. Eng., vol. 60, No. 1, January 1953, pp. 188-190.

The article was designed to give help in determining "What should you allow in a preliminary estimate for the costs of engineering, design and drafting, construction overhead and other indirect costs? When are these costs excessive?"

391. OIL AND GAS JOURNAL. Carbide & Carbon Building at Torrence, Calif. Vol. 51, No. 27, Nov. 10, 1952, p. 150.

Gives $36,000,000 as the investment cost of a plant that will produce from 50 to 60 million pounds of ethylene and 10 million gallons of ethylene glycol per year.

392. _____. Cleaning Burners........ Vol. 51, No. 36, Jan. 12, 1953, p. 116.

Describes how Socony-Vacuum saved considerable money by completely cleaning its oil burners before taking them out of service on T.C.C. cracking heaters and vapor reheaters.

393. _____. Cosden Aromatics. Vol. 52, No. 39, Feb. 1, 1954, p. 89.

Gives correction to cost of clay-treating aromatics. The figure should be 0.25 cent per barrel instead of 25 cents per barrel as appeared on page 75 of Reidel's article (ref. 465) on this subject.

394. _____. Decarbonization Process. Vol. 52, No. 46, Mar. 22, 1954, pp. 132-133.

Briefly describes the design, operation, and economics of Blaw-Knox's decarbonizing unit for processing reduced crude with the primary purpose of producing catalytic cracking feed stock. Employs two coking drums - one is hydraulically decoked while the other is operating.

395. _____. Dehydration Economics. Vol. 51, No. 26, Nov. 3, 1952, p. 66.

Editor comments on a paper (ref. 77), presented by J. M. Campbell at the Natural Gasoline Association of America meeting in Tyler, Tex., on October 24, 1952, which contained a discussion of the relative merits of four basic methods for drying natural gas.

396. OIL AND GAS JOURNAL. Developments of the Year. Part 1. Natural Gasoline in '53.... As the Journal Followed Its Progress. Vol. 52, No. 38, Jan. 25, 1954, pp. 166-167; Part 2. Refining in '53.... As Reported in a Dozen Outstanding Journal Articles. Vol. 52, No. 38, Jan. 25, 1954, pp. 172-173; Part 3. Petrochemicals in '53.... As Reported in the Journal's Pages. Vol. 52, No. 38, Jan. 25, 1954, pp. 174, 176.

Presents abstracts of a dozen significant articles each on natural gasoline, refining, and petrochemicals that appeared in 1953 issues of the Oil and Gas Journal. Some of these articles and their abstracts contain cost information.

397. _____. Errata. Vol. 52, No. 34, Dec. 28, 1953, p. 60.

States that in W. W. Bond's article on preparing preliminary job estimates (ref. 39) figures 1 and 8 were inadvertently transferred and the ordinate of figure 2 was omitted and should read "Design Pressure, p.s.i.g."

398. _____. Gas Research Needed........ Vol. 51, No. 26, Nov. 3, 1952, pp. 73-74.

Gives brief synopsis of several papers presented at the Atlantic City meeting of the Operating Section of the American Gas Association. Gives a cost of 55 to 65 cents per 1,000 cubic feet for synthesis gas from $4-per-ton coal. Cost of process fuels is from 27 to 32 cents, or about 50 percent of the above figure. For each $1 change in coal cost there is about 6 cents change in the gas cost.

Gives round investment figures, from 1940 to 1950, for plastic, rubber, fiber, etc. plants.

399. _____. Grace Chemical Will Make Ammonia, Urea........ Vol. 52, No. 3, May 25, 1953, pp. 246-247.

Briefly discusses plants under construction and the proposed plant of Grace Chemical, which will employ partial oxidation of natural gas to produce synthetic ammonia. Grace's plant will cost $19,000,000 and will produce 250 tons of ammonia per day.

400. _____. Gulf Oil Corp. Enlarging Chemical Interests. Vol. 51, No. 27, Nov. 10, 1952, p. 150.

Very briefly discusses Gulf Oil's chemical expansion program. Gives $19 million as the investment cost for a plant to produce 180 million pounds of ethylene per year and an "isooctyl plant" to produce 9,000,000 pounds of heavy alcohol per year.

401. _____. New Black Process........ Vol. 51, No. 29, Nov. 24, 1952, pp. 72-73.

Briefly describes the design and applications of Lynn Carbon Black's low-cost process for making carbon black from flare gas. Contains information similar to but not identical to that in ref. 106. Gives brief statement on investment costs.

402. _____. New Reforming Process........ Vol. 52, No. 28, Nov. 16, 1953, pp. 186-187.

Briefly discusses Stanolind's ultraforming process. Gives catalyst replacement cost of $4 per pound, or from 4 to 13 cents per barrel of reformate.

403. OIL AND GAS JOURNAL. New Synthesis Plant Puts Salt Lake in Ammonia Race. Vol. 52, No. 43, Mar. 1, 1954, p. 47.

Briefly describes the processing steps involved in Salt Lake Chemical's synthetic ammonia plant. Gives investment cost of $6 million for this plant that will produce 120 tons of ammonia and 30 tons of dry ice per day.

404. _____. Portable Scaffold Support. Vol. 51, No. 25, Oct. 27, 1952, p. 131.

Discusses design of suspension scaffold supports. Gives advantages of and savings possible by using these supports, as demonstrated at the Adams Terminal ammonium sulfate plant of Phillips Chemical Co.

405. _____. Protection is Profit........ Vol. 51, No. 47, Mar. 30, 1953, p. 64.

Contains editorial comments on the paper (ref. 222) by Stetson and Douglas, that deals with cathodic protection of heat-transfer equipment.

406. _____. Revolution in Engines?........ Vol. 52, No. 7, June 22, 1953, pp. 146-147.

Discusses the new free-piston gas turbine. Gives estimated percentage reduction in costs of fuel, installation, and maintenance for this type over the conventional unit. Contains similar information to ref. 96.

407. _____. Scale Costs Money........ Vol. 51, No. 30, Dec. 1, 1952, pp. 65-66.

Summarizes a paper on maintenance of heat-transfer equipment (ref. 177) presented by J. S. Connors on November 1 at the N.G.A.A. meeting in Amarillo. Estimates that fouling in a heat exchanger and the resulting heat loss can mean a loss of $15,000 per year.

408. _____. Shale-Oil Costs........ Vol. 51, No. 27, Nov. 10, 1952, p. 84.

Summarizes comments made by Boyd Guthrie at the recent Rocky Mountain Oil and Gas Association convention in Denver, Colo. Estimates a 250,000-barrel-per-day shale-oil plant could realize a return on investment from 8 to 11 percent. Gives a brief summary of plant investment costs.

409. _____. Synthetics: Still High........ Vol. 51, No. 13, Aug. 4, 1952, p. 54.

Summarizes the interim report on costs of gasoline by coal hydrogenation, as presented by the Committee on Synthetic Fuels, National Petroleum Council. This report supports the original N.P.C. report[22/] on coal hydrogenation and concludes that the Bureau of Mines has placed too mush emphasis on byproduct-chemical credit.

410. _____. Tests and Calculations Prove That Tank Insulation Pays Off in 19 Months! Vol. 51, No. 30, Dec. 1, 1952, p. 140.

[22/] See footnote 11 (ref. 123).

Gives results of tests carried out on a 10,000-barrel-per-day Bunker C storage tank that was insulated at a cost of $1 per square foot. Estimates payout of 19 months based on savings in steam consumption.

411. OSBORN, R. J. How to Select Motors and Controls for Pipe-Line Pumping. Oil Gas Jour., vol. 52, No. 32, Dec. 14, 1953, pp. 111-112, 114, 116, 119.

Discusses items that must be specified in selecting motors and includes relative costs of low- and high-speed motors, as well as, a cost comparison of 1,000 hp. motors having various types of enclosures, speeds, and voltages.

412. PARK, T. S., JR. The Combustion Gas Turbine in Natural-Gas Transmission. Part 1. Oil Gas Jour., vol. 53, No. 7, June 21, 1954, p. 171; Part 2. Oil Gas Jour., vol. 53, No. 8, June 28, 1954, p. 129.

Part 1 is the fourth article and Part 2 is the fifth article in a series on combustion gas turbines in natural-gas transmission. The first three articles contain no cost information. Part 1 deals with installation costs of gas-turbine-driven centrifugal compressor stations. Part 2 discusses some aspects of operating costs for gas-turbine-driven compressors for pipeline service.

413. PAULUS, M. G. Letters: Combination Processing. Petrol. Proc., vol. 8, No. 12, December 1953, p. 1807.

This is a letter by M. G. Paulus to the editor commenting on the article on combination processing by Adams and Price (ref. 3), telling that the principles set forth in their article had been used in designing a new 30,000-barrel-per-day refinery and expressing the belief that this type processing would be increasingly employed. See ref. 426 also.

414. PAYNE, J. W., EVANS, L. P., BERGSTROM, E. V., and BOWLES, V. O. Thermofor Catalytic Reforming. Petrol. Proc., vol. 7, No. 7, July 1952, pp. 966-969.

Discusses the thermofor catalytic reforming (TCR) process, mechanical design of commercial reforming units, and pilot-plant reforming data. Compares economics of TCR with thermal reforming and the additional required catalytic polymerization. Contains the same cost information as ref. 415 but somewhat less discussion.

415. _____. Thermofor Catalytic Reforming.... An Answer to Demand for Higher Octane Numbers. Oil Gas Jour., vol. 51, No. 28, Nov. 17, 1952, pp. 357, 360-362, 364-365, 367-368.

Contains the same cost as ref. 414 but somewhat more discussion.

416. PECHMANN, WALTER V. Plant Management. Part 1. Ind. Eng. Chem., vol. 45, No. 4, April 1953, pp. 99A-100A, 102A; Part 2. Ind. Eng. Chem., vol. 45, No. 7, July 1953, pp. 97A-99A.

Part 1 discusses planning, control, and finance in management operations and lists the percentages of finances attributed to a number of individual items catalogued under cost accounting. Part 2 deals with progress control charts and discusses reasons for failure of cost accounting statistics, especially when applied to development projects, research programs, and special manufacturing operations.

417. PETROLEUM ENGINEER. The Autofining Process........ Vol. 24, No. 7, July 1952, pp. C-31-32.

Discusses Anglo-Iranian's new catalytic desulfurization process. Includes total within-battery-limits investment cost of $700,000 for a 3,500-barrel-per-day plant built in 1951.

418. _____. DMT Plant Underway. Vol. 26, No. 2, February 1954, p. C-4.

Gives $4 million as the investment cost for a plant that will produce 12 million pounds of dimethyl terephthalate from para-xylene by direct oxidation.

419. _____. Shale Oil Pilot Plant. Vol. 26, No. 3, March 1954, p. C-3.

A. C. Rubel, vice president of Union Oil, proposes that the Federal Government construct a pilot plant for 5 to 7.5 million dollars at Rifle, Colo., to handle 1,000 or more barrels of shale oil per day. Estimates that motor fuel from shale would cost 16.2 cents per gallon, delivered at Los Angeles, compared to 13.1 cents for petroleum gasoline.

420. PETROLEUM PROCESSING. Continuous Contact Coking. Vol. 8, No. 12, December 1953, pp. 1882-1883.

This is a condensation of refs. 359 and 360, which contain the information in a paper entitled "The Lummus Continuous Contact Coking Process" presented by Mekler, Schutte, and Whipple at the 33d annual meeting of the American Petroleum Institute, November 9, 1953, Chicago, Ill.

421. _____. "Corrosion Costs $250 Million a Year" - API. Vol. 8, No. 12, December 1953, p. 1868.

States that an API official estimates that corrosion may be costing refiners a quarter of a billion dollars a year. See also ref. 434.

422. _____. First Plastic Tank Truck. Vol. 8, No. 10, October 1953, p. 1531.

Describes a 3,400-gallon plastic tank truck for transporting formaldehyde and similar chemicals. Truck weighs 34 percent less than the steel counterpart. Estimates an annual pay load increase of $3,000 possible.

423. _____. "Foam" Floating Roof Pays Off........ Vol. 8, No. 12, December 1953, pp. 1884-1888.

Contains essentially the same cost information as refs. 211 and 212 but somewhat different discussion.

424. _____. How to Reduce Maintenance Costs. Vol. 8, No. 8, August 1953, pp. 1201-1202.

Summarizes the paper entitled "Reducing Maintenance Costs by Special Studies" presented by M. H. Howarth at the Third Plant Maintenance Conference and Show, Philadelphia, Pa. Discusses the advantages of analyzing the details of each job, as the best way of obtaining optimum maintenance. Gives an example in which motor maintenance was $80, where a new motor could have been purchased for $50. Reveals also how manhours could be saved.

425. PETROLEUM PROCESSING. Largest Foam Unit. Vol. 8, No. 5, May 1953, p. 709.

Discusses Richfield Oil's foam-type firefighting truck that cost $40,000 and delivers 800 gallons of foam per minute.

426. _____. Letters: Combination Processing. Vol. 9, No. 1, January 1954, p. 16.

These are letters, by W. R. Argyle and O. N. Miller to the editor, commenting on the article on combination processing by Adams and Price (ref. 3). Editor comments briefly on the comments by M. G. Paulus (ref. 413) concerning this same article.

427. _____. Letters: Corrosion Costs. Vol. 9, No. 2, February 1954, pp. 158-160.

These are letters by H. F. West, L. M. Goldsmith, Lewis Gross, P. D. Barton, and P. E. Darling to the editor commenting on Petroleum Processing's article on corrosion costs (ref. 434).

428. _____. New Plant for Synthesis of Phenol - 1st on West Coast. Vol. 9, No. 2, February 1954, pp. 238-241.

Describes Monsanto's new phenol plant at Avon, Calif. States that, "Monsanto received a DPA certificate of necessity about two years ago for new phenol facilities at Monsanto, Ill., at a cost of $5,403,478. That certificate was later amended to $7,030,875 in July of '52, and apparently applied to the Avon project. One report, however, pegs output at Avon at a level of 30 million lbs./yr."

429. _____. One-Man Unit Fills 1,000 Drums per Day. Vol. 8, No. 11, November 1953, pp. 1729-1730, 1732.

Describes a machine that can fill 1,000, 55-gallon drums in an 8-hour day. Gives cost of this machine and the estimated savings possible by using it instead of the previous conventional filling method.

430. _____. Save Time, Men With Mobile Drum Filler. Vol. 8, No. 4, April 1953, pp. 567, 569.

Describes a new, mobile drum-filling method and shows savings in time and labor the new method accomplishes over the old method. Gives cost of this new filler at less than $1,000; the machine can fill 1 drum per minute.

431. _____. Sprayed Insulation Reduces Maintenance. Vol. 9, No. 2, February 1954, pp. 245, 247.

Describes Sinclair's method for insulating storage tanks. Gives cost of 35 to 65 cents per square foot for a 1/4-inch layer of sprayed insulation plus 10 to 15 cents per square foot labor charge. Fiberglass and aluminum sheet insulation costs $1.35 per square foot.

432. _____. Three New Refining Processes, Continuous Lube Oil Decolorizing and Two Catalytic Desulfurizing Methods........ Vol. 8, No. 5, May 1953, p. 683.

Presents brief editorial summaries of several papers presented at the American Petroleum Institute's Division of Refining 18th Mid-Year Meeting in

New York, May 11-14, 1953. Some investment and operating costs are included in these abstracts of papers dealing with autofining; thermofor continuous percolation (TCP), hot contacting, static bed treatment for lube oil refining; and trickle hydrodesulfurization and gas phase hydrogenation for sulfur removal in gas oils.

433. PETROLEUM PROCESSING. Want Lower Costs on Can Fillings?........ Vol. 7, No. 7, July 1952, pp. 964-965.

Editor summarizes a paper entitled "The Control of Lube Oil Can Filling" presented by Bob Mellon and Richard Beck before the Packaging Institute, 13th Annual Forum, October 22-24, 1951, New York, N. Y. Describes a lube-oil can-filling machine developed by Gulf Oil and gives estimated savings accomplished by this machine.

434. _____. What Does Corrosion Cost You?........ Vol. 8, No. 11, November 1953, pp. 1685-1688.

This is a staff report by the editors of Petroleum Processing. The report discusses refinery corrosion. Gives possible direct corrosion costs for 35 oil companies, by companies, but not broken down into types of processing; all figures are general. Estimates total yearly corrosion cost to refiners of over $220 million or 9 cents per barrel of crude oil processed. Also see refs. 421 and 427.

435. _____. What's Unique About Tuscola?........ Vol. 8, No. 12, December 1953, pp. 1889-1891.

Discusses the unique features of National Petrochemical's plant at Tuscola, Ill., and makes general comments about its operations. Gives $50 million as the investment cost of this plant that will recover daily 10 million std. cu. ft. of ethane, 380,000 gallons of propane, 21,300 gallons of isobutane, 57,400 gallons of normal butane, and 18,520 gallons of gasoline (C_5+) from a natural gas stream. Plant also cracks ethane to ethylene - daily production is 600,000 pounds of ethylene and 8 million std. cu. ft. of hydrogen. Plant produces, as primary products, 40 million gallons of ethyl alcohol, 3 million gallons of diethyl ether, and 50 million pounds of ethyl chloride per year. A 50,000-ton-per-year ammonia plant costing $7 million will be added.

436. _____. You Save When You Classify Your Maintenance Costs. Vol. 8, No. 9 September 1953, pp. 1358, 1360.

Summarizes a paper entitled "Classification of Maintenance Costs" presented by C. E. Knight at the Third Plant Maintenance Conference and Show, Philadelphia, Pa. Gives no actual cost figures, but discusses how to classify maintenance costs to reduce maintenance operations' costs.

437. PETROLEUM REFINER. Compare These Experiences of Corrosion in Sweetening Units........ Vol. 33, No. 4, April 1954, pp. 135-137.

This is an abstract of a paper compiled by B. W. Bradley, R. W. Schutt, W. V. Alleman, R. L. Elkins, and G. O. Hult and presented to the Corrosion Research Project Committee of N.G.A.A. Describes the corrosion observed in two solid-bed copper chloride sweetening units. Includes both maintenance and investment costs for Perco-bed vessels used in, and for storage tanks used with these treating units.

438. PETROLEUM REFINER. Esso Considering This Plan for Underground Product Storage. Vol. 32, No. 8, August 1953, p. 148.

Briefly discusses adaption of abandoned slate pits in Northeastern Pennsylvania to underground storage of home-heating oils. Says that steel tankage and necessary pipelines and facilities average about $2 per barrel of storage capacity, whereas the average quarry storage would be from 25 cents to $1 per barrel, depending upon the type of roof used.

439. _____. Interview With a Gasoline Specialist.... Do Gasoline Plants Pay Out? .... Vol. 33, No. 4, April 1954, pp. 112-114.

The editor interviews H. E. Vaughan to determine "Are we reaching the point where there isn't enough difference between the price of the unprocessed gas and the gas converted to liquid through a plant process to justify installation of a plant?" Article is in question-and-answer form and deals with factors that have affected gasoline plant economics. Gives a chart that shows net operating income for a gasoline plant and a cycling plant in which operating conditions and other conditions were held constant and only the price of gas fluctuated (3, 10, and 20 cents per 1,000 cubic feet).

440. _____. Kellogg Ammonia Process. Vol. 33, No. 3, March 1954, p. 150.

Briefly discusses design, operation, and operating data for the Kellogg ammonia process. Gives erected plant costs for 60, 100, and 150-ton-per-day plants with 4 different compressor installations.

441. _____. The Kellogg Delayed Coking Process. Vol. 32, No. 7, July 1953, pp. 108-109.

Describes the Kellogg delayed coking process and includes a brief economic comparison between delayed coking and vacuum distillation.

442. _____. Make Your Own Strain Gage Instrument........ Vol. 33, No. 4, April 1954, pp. 189-190.

Tells how to construct a strain gage for approximately $50. The idea was presented by E. H. Collender at the Symposium on Instrumentation for the Process Industries held at College Station, Tex., January 29, 1954.

443. _____. Now in Operation.... Second Ammonia Plant for Shell. Vol. 33, No. 2, February 1954, p. 112.

Briefly discusses Shell's second synthetic ammonia plant. Gives investment cost of approximately $10 million for this plant that has a capacity of 150 tons of anhydrous ammonia per day.

444. _____. Sinclair Has New Reforming Process........ Vol. 32, No. 6, June 1953, pp. 143-144.

Discusses Sinclair's new catalytic reforming process for aromatics' production. Gives catalyst cost of 2 to 10 cents per barrel of reformate and direct operating cost of 21 cents per barrel of reformate.

445. PETROLEUM REFINER. Take Another Look at Gas Turbines........ Vol. 32, No. 12, December 1953, p. 120.

Briefly discusses the four companies' experiences with gas turbines. Gives installation and maintenance costs for gas turbines and compares operating costs of gas-turbine compressor stations with conventional compressor stations.

446. PFEIFER, V. F., VOJNOVICH, CHARLES, and HEGER, E. N. Vitamin B_{12} by Fermentation With Streptomyces Olivaceus. Ind. Eng. Chem., vol. 46, No. 5, May 1954, pp. 843-849.

Describes a pilot-plant experiment in which vitamin B_{12} liquors and concentrates were produced by fermentation of neutral substrates with S. olivaceus. Gives estimated investment and operating costs for a plant with daily capacity of 28.5 grams of vitamin B_{12}.

447. _____. Pilot Plants; Itaconic Acid by Fermentation With Aspergillus Terreus. Ind. Eng. Chem., vol. 44, No. 12, December 1952, pp. 2975-2980.

"This paper describes pilot plant experiments in which itaconic acid was produced by fermentation of corn sugar with Aspergillus terreus NRRL 1960 and also experiments dealing with the recovery methods used to obtain crystalline itaconic acid. This pilot plant evaluation was undertaken to find suitable operating conditions for the process on a commercial scale. An approximate cost estimate is included, based on engineering data obtained from the fermentation and recovery investigations."

448. PHILLIPS, R. J. A Survey.... Inspection Practices and Problems........ Petrol. Refiner, vol. 33, No. 1, January 1954, pp. 116-118.

Discusses, in question-and-answer form, scheduling and coordination, turn around times, and organization. Gives maximum, minimum, and average salary and material budgets for inspection budgets for small, medium, and large refineries.

449. PIERCE, D. E. Equipment and Design........ Ind. Eng. Chem., vol. 45, No. 6, June 1953, pp. 81A-82A, 84A.

Points out "Any savings effected in the cost of maintenance and repairs will increase operating profit by the same amount." Includes several graphs to assist a person in obtaining "a qualitative measure of how much the cost of maintaining and repairing a plant means to the average company."

450. _____. How to Control Costs by Kilowatts. Chem. Eng., vol. 60, No. 1, January 1953, pp. 195-197.

Presents a new approach to operating standards and budgets. Deals with cost control and the "basic principle is that the amount of energy consumed in a plant is a measure of the plant's activity." Also see ref. 525.

451. PISTOLE, HARRY, and SULLIVAN, B. M. Application of Automatic Controls to Wells and Tank Batteries in the East Texas Area. Petrol. Eng., vol. 24, No. 8, Reference Annual 1952, pp. B-3, 7-10.

Discusses automatic controls for wells and tank batteries. Gives cost of about $700 per tank for purchase and installation of either electric or pneumatic automatic control equipment for a tank battery.

452. PLANK, E. S. Two New Instruments Promise to Improve Accuracy and Economy of Gas Measurement........ Oil Gas Jour., vol. 53, No. 1, May 10, 1954, pp. 113-115, 121-122.

Discusses Tennessee Gas Transmission's program to "refine and improve the physical equipment for orifice-meter measurement." Gives the dollar savings made by reducing meter reading error.

453. RADECKE, F. T. Control Corrosion Costs With a Painting System That Really Works........ Petrol. Refiner, vol. 33, No. 5, May 1954, pp. 172-176.

Discusses Shell's scientific painting program in detail, and includes costs of preparing surfaces for painting and relative costs and life expectancy curves for tanks.

454. RASE, H. F. Take Another Look at Economic Pipe Sizing........ Petrol. Refiner, vol. 32, No. 8, August 1953, pp. 141-143.

Presents a rapid method for estimating piping costs. The author claims that by using this method the engineer can determine which particular lines require more detailed study. Contains tables that list prices, and factors for determining prices, for pipe, fittings, flanges, valves, and fabricating.

455. RATLIFF, R. A., and STROBEL, W. B. New Look on How to Produce Aromatics by SO_2 Process........ Petrol. Refiner, vol. 33, No. 5, May 1954, pp. 151-155.

Discusses a commercial sulfur dioxide unit for simultaneous extraction of benzene, toluene, and xylene. Unit employs hydrocarbon wash oil in the extraction tower, single-stage separation of sulfur dioxide from the raffinate, and methanol azeotropic distillation for improving "benzene study". Includes investment and operating costs for a modified sulfur-dioxide plant. Contains essentially the same cost information as ref. 456 but more other data and discussion.

456. _____. Simultaneous Extraction of Benzene and Toluene by the Sulfur Dioxide Process. Oil Gas Jour., vol. 53, No. 4, May 31, 1954, pp. 87-89.

Contains essentially the same cost information as ref. 455 but less other data and discussion.

457. REED, PAUL. Gas-Turbine Report........ Oil Gas Jour., vol. 51, No. 50, Apr. 20, 1953, pp. 104-105.

Briefly discusses the performance of the first gas turbines used in major long-line gas transmission. Estimates the cost of these turbines is $50 less per installed horsepower than for reciprocating engines. See ref. 494 for a detailed discussion of El Paso Natural's experiences with gas turbines for gas transmission.

458. REESE, AL. They Fight Their Neighbors' Fires........ Petrol. Refiner, vol. 32, No. 9, September 1953, pp. 276-281.

Discusses a cooperative fire-fighting company for combatting refinery fires. Gives costs of equipment, storage, and personnel.

459. REESE, AL. Why Are Compensation Costs Higher?........ Petrol. Refiner, vol. 32, No. 2, February 1953, pp. 75-76, 78.

Discusses recent Texas legislation on insurance rates as it concerns the petroleum industry. Includes considerable insurance cost data.

460. REIDEL, J. C. The Engineering Contractor and How He Functions in Building Oil and Gas Processing Industry. Oil Gas Jour., vol. 51, No. 46, Mar. 23, 1953, pp. 278-279, 281-282, 284, 309-310.

Generally describes what is involved in the design, purchasing, and erection of process units. Gives investment cost for a catalytic cracking unit as $400 per daily barrel of throughput capacity. Contains a list of field erection equipment maintained by a small refinery engineering company and costing $200,000. Includes a breakdown of salaried personnel employed by engineering construction companies.

461. _____. 53 Million Gallons of B.T.X. Annually........ Oil Gas Jour., vol. 52, No. 47, Mar. 29, 1954, pp. 94-96.

Discusses Sun Oil's new aromatics plant that utilizes the houdriforming and udex processes. Gives $15 million as the investment cost of this plant with a yearly design capacity of 19 million pounds each of benzene and toluene and 15 million pounds of mixed xylenes.

462. _____. L.P.G. Goes Underground. Oil Gas Jour., vol. 51, No. 10, July 14, 1952, pp. 70-71.

Discusses types, cost, extent, and location of underground liquefied petroleum gas storage.

463. _____. L.P.G. Goes Underground for Summer. Oil Gas Jour., vol. 51, No. 12, July 28, 1952, pp. 260-261, 300, 302.

Presents a roundup on the types of underground storage being used, cavity engineering, and the costs and capacities of different types.

464. _____. "Natural Gas to Ammonia - 1, A Look at Round 2 of NH_3 Expansion." Oil Gas Jour., vol. 52, No. 44, Mar. 8, 1954, pp. 86-91, 109-110, 112.

Discusses in some detail ammonia-urea production that involves the following steps: (1) Steam-methane reforming at elevated pressure, (2) near-isothermal ammonia conversion, and (3) Montecatini urea manufacture. Shows ammonia plant construction for 1953 and 1954, listing plant investment, capacities, products, location, etc. Gives erected costs for several sizes of plants charging various feeds and employing the Kellogg ammonia process.

465. _____. Petrochem Report: Small Refinery, But Big Products List........ Oil Gas Jour., vol. 52, No. 35, Jan. 4, 1954, pp. 72-75, 91.

Discusses Cosden Petroleum's petrochemical production facilities at Big Spring, Tex. Contains some processing cost figures, including cost of utilizing treated sewage effluent for boiler feed water. See ref. 393 for a correction to above cost figures.

466. REIDEL, J. C. Unique Ammonia Plant Opened. Oil Gas Jour., vol. 52, No. 40, Feb. 8, 1954, pp. 60-62.

Discusses the world's first ammonia plant to employ partial oxidation of natural gas. Gives $14 million as the investment cost for this plant that has been designed with a basic daily capacity of 210 tons of anhydrous ammonia. "Other process facilities have been installed to make 110 tons of nitric acid, 140 tons of ammonium nitrate solution, and 350 tons of 'Spensol' (ammoniating solutions) per day."

467. RESCORLA, C. L. Refrigeration and Refrigerants........ Chem. Eng., vol. 60, No. 6, June 1953, pp. 200-207.

Discusses design, operation, and a number of applications of commercial refrigeration. Includes properties of various refrigerants and a graph that shows the average refrigeration-plant-equipment costs for operation at various evaporator temperatures; system capacities are 5, 25, 100, and 500 tons (apparently tons per day).

468. RESEN, F. L. Asphalt Uses Growing........ Oil Gas Jour., vol. 51, No. 24, Oct. 20, 1952, p. 84.

The editor gives a synopsis of several papers presented at the W.P.R.A. meeting in El Dorado, Ark. Two of these summaries contain cost information. One of these entitled "Closed dehydration systems" by Layton Boyd discusses gas-dehydration systems and mentions the savings over conventional methods effected by using this system for propane dehydration. The other entitled "Sulfur economics" by J. H. Eppard presents an economic analysis of a 12.9-ton-per-day sulfur recovery plant at a 20,000-barrel-per-stream-day refinery.

469. _____. Fuel-Saving Idea........ Oil Gas Jour., vol. 52, No. 48, Apr. 5, 1954, p. 61.

Editor discusses comments, made by T. W. Legatski and H. J. Elder at the W.P.R.A. meeting in San Antonio. They stated that considerable savings can be made by blending more butane in summer gasoline rather than by burning it as boiler fuel.

470. _____. How to Cement-Line Pipe for Corrosion Resistance. Oil Gas Jour., vol. 52, No. 30, Nov. 30, 1953, pp. 91, 93-95.

Discusses Freeport Sulfur's simple cement-lining method and its application to various types of piping service. Gives investment cost between $15,000 and $17,000 for a pipe-lining plant.

471. _____. New Column Design........ Oil Gas Jour., vol. 51, No. 25, Oct. 27, 1952, p. 76.

Under the above caption appear abstracts of several papers presented at the annual technical session of the South Texas Section, American Institute of Chemical Engineers, on October 21, 1952, at Galveston, Tex. The abstract entitled "Arosorb analysis" contains a breakdown of investment and operating costs for an arosorb unit processing daily 1,555 barrels of a 300°-400° F. naphtha fraction. This paper was given by E. R. Weatherly and H. G. Shimp.

472. RESEN, F. L. Petrochem Report: Phillips Chemical Co., Houston. Oil Gas Jour., vol. 51, No. 9, July 7, 1952, pp. 58-59.

Discusses expansion at Phillips Chemical Houston, Tex., plant. Gives $38,260,000 as the investment cost of a plant that will produce daily 750 short tons of ammonium sulfate and 450 short tons of synthetic ammonia. Gives $3,500,000 as the investment cost of a plant that will produce 3 million pounds of synthetic pyridines annually.

473. _____. Profit Shrinking........ Oil Gas Jour., vol. 51, No. 52, May 4, 1953, p. 75.

Summarizes Vaughan's paper on gasoline and cycling plant economics (refs. 569 and 570).

474. _____. Quicker Cost Estimating. Oil Gas Jour., vol. 52, No. 25, Oct. 26, 1953, pp. 59-60.

Gives brief editorial comments on three papers on cost estimating (refs. 251, 273, and 288) presented at the eighth annual meeting of the South Texas Section, American Institute of Chemical Engineers, at Galveston, Tex.

475. _____. Silicones - New Tools for Petroleum Operations........ Oil Gas Jour., vol. 53, No. 4, May 31, 1954, pp. 66-69.

Briefly discusses the use of silicone products as defoaming agents in gas absorption and vacuum distillation units and in finished lube and fuel oils. These products are also used in wax molds to prevent adhering and in electrical insulation and protective coatings. States that the rewinding cost for a 500 hp. electric motor, for a charge pump to a combination unit, is about $1,750.

476. REYNOLDS, P. M. Pro & Con: Cascade Coolers With Hangers. Chem. Eng., vol. 60, No. 8, August 1953, p. 150.

This is a letter from P. M. Reynolds to the editor concerning certain of the information about cascade coolers that appears in the first article (ref. 489-1) of Rubin's series on heat exchanger costs.

477. REYNOLDS, S. C. Entrainment Eliminators Save Money........ Petrol. Refiner, vol. 32, No. 7, July 1953, pp. 138-140.

Discusses experiences in the use of knitted wire mesh separators in the top of lube towers, stills, etc. Estimates cost of this material at from $9 to $10 per square foot.

478. _____. Simple Solution to Processing Problem, Wire Mesh Removes Liquids From Refinery Vapors. Oil Gas Jour., vol. 52, No. 14, Aug. 10, 1953, pp. 117-118, 122.

Contains essentially the same information as ref. 477.

479. RHOADS, B. J., JR. Gas Lift Installation in the Spraberry........ Petrol. Eng., vol. 24, No. 7, July 1952, pp. B-11-12, 14, 16-18.

"An analysis of the costs, equipment, and some of the results of artificial lift using gas in the Spraberry is given here." Article is not specificially for petroleum and chemical plants but contains costs for a number of items used in them.

480. RILEY, H. G., and COLE, C. M., JR. When Does it Pay to Cycle Gas-Condensate Reservoirs?........ Oil Gas Jour., vol. 51, No. 20, Sept. 22, 1952, pp. 101-104, 107.

Discusses the purpose of cycling gas condensate reservoirs and the factors to consider in deciding whether it pays to cycle and illustrates these points by working out several examples, representing varied conditions.

481. ROBINSON, E. T., JR. Here Are Some Interesting Figures on Economics of Internally Cleaning Gas Lines During Operation........ Oil Gas Jour., vol. 52, No. 12, July 27, 1953, pp. 375-379, 381-382, 384-386.

Outlines the procedure for economical, efficient internal cleaning while gaslines are operating. Gives a cost of $1.75 to $2.25 per mile for this new cleaning method. Gives average per-mile cost for atmospheric cleaning at $91.42.

482. RODES, T. W. Materials Handling........ Ind. Eng. Chem., vol. 45, No. 6, June 1953, pp. 114A, 116A, 118A.

Discusses the importance of planning for prompt loading and unloading of railroad cars to effect savings by eliminating demurrage penalties.

483. RODGER, W. A. Radioactive Wastes; Treatment, Use, Disposal. Chem. Eng. Prog., vol. 50, No. 5, May 1954, pp. 263-266.

Discusses several chemical engineering techniques for disposal of radioactive wastes to supplant or augment the temporary methods first used. Gives costs for bulk reduction of waste by evaporation, flocculation, ion exchange, and electric deionization. Also includes storage costs.

484. RODGERS, W. J. Eliminate Loading Loss by Spray Loading of Tank Cars........ Oil Gas Jour., vol. 52, No. 36, Jan. 11, 1954, pp. 92-94.

Discusses a method of loading tank cars and its merits. Gives the following costs for converting a transport truck tank to top loading:

	Dollars
Two valves	60
Two excess flow valves	19
Tank steaming	30
Welding	20
Miscellaneous fittings	20
Shop labor	20
Cage and cover to guard valves	30
	199

485. RODGERS, W. J. New Developments in Loading Tank Cars........ Petrol. Refiner, vol. 33, No. 1, January 1954, pp. 151-153.

Contains essentially the same information as ref. 484.

486. ROTH, E. R., and MASOLOGITES, G. P. Recorders and Controllers in Pilot Unit Instrumentation. Ind. Eng. Chem., vol. 45, No. 9, September 1953, pp. 1845-1849.

Discusses instrumentation for pilot plants. Includes the statement, "In general, total installed instrumentation costs for pilot units at Atlantic Refining vary between a low of 10% and a high of 20% for units costing about $30,000 and $60,000. This percentage may range as high as 40% for bench-scale units."

487. RUBEL, A. C. A Critical Look at Oil Shale. Mines Mag. (Colorado), vol. 44, No. 3, March 1954, pp. 75-78, 92.

The article constitutes a critical review of the entire oil-shale and shale-oil field presented as an aid for evaluating the current position of the United States with respect to liquid fuels' reserves. Includes costs for shale gasoline and investment costs for shale-oil operations.

488. _____. U. S. Petroleum Supply Can Draw Upon Wealth of Resources and Resourcefulness. Petrol. Eng., vol. 25, No. 9, August 1953, pp. A-37-40.

Briefly discusses the effect of petroleum and petroleum products on our everyday lives. Also discusses the future of the petroleum industry, including the potential of various sources of petroleum products or synthetics other than crude petroleum. Gives costs of gasolines from oil shale.

489. RUBIN, F. L. Heat Exchanger Costs Today........ Part 1. Chem. Eng., vol. 60, No. 5, May 1953, pp. 201-206; Part 2. Chem. Eng., vol. 60. No. 7, July 1953, pp. 177-181; Part 3. Chem. Eng., vol. 60, No. 9, September 1953, pp. 229-233; and Part 4. Chem. Eng., vol. 60, No. 10, October 1953, pp. 196-202.

Part 1 considers, for heat exchangers, the initial cost, installation cost, size and weight, maintenance charges, probabilities for leakage, replacement part costs, expected equipment life, and applicability to other services. Covers the following types of exchangers: Shell and tube, fired-tube, U-tube, packed head, small standard shell and tube, and impervious graphite. Part 2 presents the data to determine how much pressure, temperature, and alloys boost exchanger costs. Gives costs, physical data, and designs for conventional floating-head, U-tube, lock-joint floating head, and lock-joint U-tube types of heat exchangers, as well as for various alloyed pipe and tubing. Part 3 contains costs, physical data, and designs for several types of reboilers and exchangers, both the single and multiple section varieties. These include kettle-type reboiler, tank suction heaters, double-pipe exchangers, and fin-tube exchangers. Part 4 gives costs, physical data, and designs for the following types of heat exchangers and their component parts: Spiral plate, spiral tube, plate coil, cascade, self cleaning tubular, bayonet tube, air-cooled, cubic, and tantalum. See also ref. 476.

490. **RUBIN, F. L.** Pro & Con: Depreciation and Costs. Chem. Eng., vol. 61, No. 6, June 1954, pp. 407-409.

This is a letter from F. L. Rubin to the editor expressing disagreement with some points in Hartogensis' and Allen's article on depreciation charges (ref. 277) and Jelen's article on capitalized costs (ref. 297).

491. **RUSHTON, J. H.** Pro & Con: Speeds and Mixer Costs. Chem. Eng., vol. 60, No. 4, April 1953, pp. 160, 162.

This is a letter from J. H. Rushton to the editor commenting on Lewis' article on mixer costs (ref. 325) and pointing out certain disagreements but commending the article generally.

492. **SANDERS, H. J., GARDINER, W. C., and Wood, J. L.** Mercury Cell Chlorine and Caustic. Ind. Eng. Chem., vol. 45, No. 9, September 1953, pp. 1824-1835.

Presents an extensive staff-industry collaborative review of the chlor-alkali industry from about 1935 to 1952. Gives investment cost of $10,425,000 for a 100-ton-per-day mercury cell chlorine plant; the mercury investment was $1,060,000, based on $208 per flask.

493. **SANDERS, H. J., and TAFF, A. W.** Allethrin. Ind. Eng. Chem., vol. 46, No. 3, March 1954, pp. 414-426.

Discusses the total synthesis of allethrin. Gives $6 million as the investment cost for a plant, under construction, that will be able to produce between 400,000 and 500,000 pounds of allethrin per year.

494. **SAWYER, S. R.** Gas Turbine Experiences on El Paso Natural's Lines. Petrol. Eng., vol. 25, No. 13, December 1953, pp. D-38, 40-41, 43, 45-46, 48, 50.

Discusses operating experiences and costs, construction costs, layout, design, and operating principles of the first large-scale use of gas-turbine-driven centrifugal compressors.

495. **SAYRE, J. E.** Phthalic Anhydride. Chem. Eng. News, vol. 30, No. 49, Dec. 8, 1952, pp. 5138-5142.

This is a commodity survey on phthalic anhydride. Includes an assumed cost for phthalic anhydride production and contains a brief summary of costs for coal hydrogenation.

496. **SCHROEDER, W. C.** Gasoline and Oil From Oil Shale. Mines Mag. (Colorado), vol. 42, No. 12, December 1952, pp. 31-32, 60.

Briefly discusses: (1) The possibilities of a synthetic fuels' industry based on oil shale; (2) oil-shale operations abroad; (3) improvements in mining shale; (4) development in shale retorting; (5) refining shale oil; and (6) the competitive position of a shale industry. Gives costs of shale gasoline and shale mining. Compares investment costs per-barrel-of-crude capacity for shale oil and petroleum.

497. **SCHUBER, JOHN, and KRASKE, W. A.** New Outlook for Chlorine Dioxide........ Chem. Eng., vol. 60, No. 9, September 1953, pp. 205-207.

Describes a new method for producing chlorine dioxide at the point of consumption. Gives the cost of equipment as between $150,000 and $170,000 for a plant that can produce 3 tons of chlorine dioxide daily.

498. SCHUH, W. R. ....Why Not Bend That Pipe?........ Petrol. Proc., vol. 9, No. 1, January 1954, pp. 58-59.

Discusses advantages and savings possible by bending small pipes to reduce the number of fittings needed. Includes brief cost summary for fittings, pipe, and labor.

499. SCHWARTZ, SEYMOUR. 12 Ways to Save on Sulfur........ Chem. Eng., vol. 60, No. 11, November 1953, pp. 208-210.

Suggests possible economies to offset effects of severe sulfur shortages and increased material and labor costs. Includes costs due to losses from wind blowing on sulfur storage piles, transportation and total delivery charge for brimstone from gulf coast mines to various locations and by various means, and power cost reduction in an acid plant.

500. SCHWEYER, H. E. Cost Estimation for Process Operations. Chem. Eng. News, vol. 31, No. 32, Aug. 10, 1953, pp. 3266-3270.

Presents two cost-estimating methods and gives a detailed breakdown and explanation of the factors that must be considered in making such estimates.

501. _____. How Inventory Costs Affect Your Process Economics........ Chem. Eng., vol. 60, No. 10, October 1953, pp. 188-192.

Gives a fundamental, mathematical approach to solving the problem, "How do storage and interest charges on materials in inventory influence the optimum length of run?"

502. SCRUGGS, C. H. Electronic Controls for Product Terminals........ Petrol. Eng., vol. 25, No. 8, Reference Annual 1953, pp. D-3-4.

Describes an electronic control system for product terminals. Includes costs for control panels, remote control and indicating units, motor control units, and coaxial cable.

503. SEEBOLD, J. E., BERTETTI, J. W., SNUGGS, J. F., and BOCK, J. A. Fluid Hydroformer at Destrehan........ Petrol. Eng., vol. 24, No. 8, Reference Annual 1952, pp. C-37-38, 40.

Describes the first commercial fluid hydroformer unit and anticipated operational behavior. Shows estimated operating costs.

504. SELAK, P. J., and FINKE, JOSEPH. Heavy Water........ Chem. Eng. Prog., vol. 50, No. 5, May 1954, pp. 221-229.

Presents a review of processes and plants for large-scale production of heavy water. Includes a summary of plant and equipment investment and operating costs.

505. **SELINDH, H. S.** Tooling for Refinery Maintenance........ Petrol. Refiner, vol. 32, No. 1, January 1953, pp. 125-128.

Discusses refinery maintenance and includes the cost for operating an electric motor.

506. **SERRILL, J. L., JR.** Eliminating Baneful Afterburn, New Analyzer Breaks Bottleneck in F.C.C. Operation. Oil Gas Jour., vol. 51, No. 17, Sept. 1, 1952, pp. 84, 86, 89.

Describes the design and operation of an infrared-type carbon monoxide analyzer for control of regeneration of catalytic cracking units. Gives $8 per week as the maintenance cost for this instrument.

507. **SHARPE, L. G.** ....How Good Must Pipeline Coating Be? Oil Gas Jour., vol. 53, No. 6, June 14, 1954, pp. 130-132.

Presents data from an examination of cost relationships between various pipeline-coating practices and cathodic-protection equipment requirements. This represents a portion of a paper presented at the 1954 annual meeting of the National Association of Corrosion Engineers in Kansas City.

508. **SHELL DEVELOPMENT COMPANY.** Here's the Story about the New Turbogrid Distillation Trays........ Petrol. Refiner, vol. 31, No. 11, November 1952, pp. 105-108.

Describes a new type of vapor-liquid contacting tray for fractionating operations and its performance in existing units. Shows comparative cost advantages of turbogrid trays over bubble-cap trays for several types and sizes of stabilizing and fractionating units. Also see ref. 509.

509. _____. Turbogrid Distillation Trays. Chem. Eng. Prog., vol. 50, No. 2, February 1954, pp. 57-64.

Describes design, operation, applications, and costs of the turbogrid distillation column tray. Shows comparative cost data for turbogrid trays and bubble-cap trays for a number of applications. Contains different information than ref. 508.

510. **SHERWIN, D. S.** Calculating Engineering Economics. Part 1. Utility Costs .... Petrol. Refiner, vol. 33, No. 2, February 1954, pp. 103-105; Part 2. Cost Classifications........ Petrol. Refiner, vol. 33, No. 3, March 1954, pp. 151-154; and Part 3. Overhead Costs........ Petrol. Refiner, vol. 33, No. 5, May 1954, pp. 209-211.

Part 1 discusses defects in current utility cost estimating methods and suggests a pattern to be followed in making such estimates. Also comments briefly on estimating maintenance costs. Part 2 discusses the importance of classifying costs and what constitutes the various classes of costs. Gives a detailed breakdown of plant and nonplant costs that together make up the total cost of a product. Part 3 presents a new method for determining overhead costs, as well as a discussion of the nature of overhead costs and conventional methods of estimating them.

511. SHERWOOD, P. W. An Auxiliary to Petrochemical Processing.... Tonnage Oxygen. Part 1. Rectification and Refrigeration. Petrol. Refiner, vol. 32, No. 12, December 1953, pp. 93-96; Part 2. Heat Exchange Methods and Impurities Removal. Petrol. Refiner, vol. 33, No. 1, January 1954, pp. 129-132; and Part 3. "Package" Units. Petrol. Refiner, vol. 33, No. 2, February 1954, pp. 117-122.

Part 1 contains no cost information. Part 2 discusses various types of heat exchangers used in oxygen production units and methods for removing impurities from the oxygen. Gives no actual costs but states that "Elliott-Modine finned exchanger construction costs are presumed to be larger than for regenerative exchangers because provision of spare parts is an essential part of the design." Part 3 discusses advantages and limitations of the major types of oxygen-producing processes available as packaged units. These include the following: Linde-Frankl I Cycle, Oxyton cycle, Kellogg Cycle, Linde-Frankl II Cycle, Elliott Cycle, and the Rescol Cycle. Gives considerable investment and operating cost data related to some of these processes.

512. _____. The Use of Oxygen in the Petrochemical Industry. Part 1. Basic Considerations and Commercial Partial Combustion Processes........ Petrol. Refiner, vol. 32, No. 6, June 1953, pp. 90-94; Part 2. Commercially Used Reactions, Acetylene, Ethylene, Ammonia. Petrol. Refiner, Vol. 32, No. 7, July 1953, pp. 141-144.

Part 1 discusses chemical and thermal advantages of using tonnage oxygen in petrochemical production. Discusses reaction thermodynamics of the partial combustion process for synthesis gas production. Gives investment and operating costs for several sizes of plants for producing 95-percent oxygen by the Linde-Frankl oxygen cycle. Part 2 discusses several reactions used in commercial production of acetylene, ethylene, and ammonia. Briefly discusses acetylene production costs.

513. SHUMAN, F. R., and BRACE, D. G. Versatile Process for Aromatics Recovery .... Petrol. Eng., vol. 25, No. 4, April 1953, pp. C-9-12, 14.

Presents a detailed discussion of the arosorb process. Estimates that arosorb operating costs range from 1 to 3 cents per gallon of charge.

514. SITTIG, MARSHALL. Catalytic Cracking Techniques in Review........ Petrol. Refiner, vol. 31, No. 9, September 1952, pp. 263-316.

This is an extensive review of catalytic cracking processes. Includes chemical and engineering fundamentals, operations, and maintenance aspects of fixed-bed, moving-bed, and fluidized catalytic cracking processes. Gives comparative investment and operating costs for thermal cracking and catalytic cracking and related processing.

515. SKINNER, L. C., BATCHELDER, H. R., and KATELL, SIDNEY. Comparative Cost Study of Ammonia Plants........ Ind. Eng. Chem., vol. 44, No. 10, October 1952, pp. 2381-2385.

Gives a complete breakdown of investment and operating costs for 200-, 400-, and 600-ton-per-day ammonia plants, using either natural gas or coal gasification as the synthesis gas source. Includes a thorough discussion of plant design and process principles.

516. SKINNER, WICKLIFFE. Favorable Payout Times Indicated for Field-Lease Installations. Oil Gas Jour., vol. 51, No. 30, Dec. 1, 1952, p. 126.

Summarizes a paper entitled "Economic Aspects of Natural Gasoline Production on the Lease" presented by the author at the Petroleum Mechanical Engineering Conference, A.S.M.E., Kansas City, September 1952. Compares three low-temperature separation methods with the conventional three-stage separation method for recovering liquid products from high-pressure natural gas. One table shows the daily income from each of the processes for three sizes of installations. Another table gives the additional investment costs for the low-temperature processes over the three-stage process for equivalent capacities and this table shows the payout periods for increased income to pay out the additional plant costs. Also discusses recovery of liquid products from low-pressure gas by three low-temperature methods. A table shows daily income, estimated plant costs, and payout periods for 1.5 million-cubic-feet-per-day installations using these three processes.

517. SMITH, C. O. Here's How to Provide Cathodic Protection of Steel Vessels Exposed to Oil-Field Brines. Oil Gas Jour., vol. 51, No. 51, Apr. 27, 1953, pp. 230, 232, 234, 236, 238, 240.

Explains how to determine cathodic protection requirements. Presents results of experimental studies on the subject. Tells how cathodic protection of interior surfaces can reduce corrosion, thereby reducing operating expenses. Estimates protection of a 200- to 300-barrel tank wall probably average less than $3 per month. One of the figures shows replacement costs for vessels in corrosive service.

518. SMITH, S. P. If You Ship Process Products........ Chem. Eng., vol. 60, No. 3, March 1953, pp. 222-225.

Reveals some of the problems and complexities of the traffic department. Includes costs of various types of railroad cars and barges and gives freight rates.

519. SMITH, S. S., and HARDEN, G. D. Factors Affecting Conservation of Products in Storage. Oil Gas Jour., vol. 51, No. 10, July 14, 1952, pp. 125-127.

Shows how much white paint cuts evaporation loss of petroleum products stored in tanks. Gives results of tests on various sizes of storage tanks painted white, black, aluminum, or combinations of these colors. Compares costs of aluminum and white paints. Claims a net savings of $1,500 per year on a white 80,000-barrel tank compared to one painted aluminum; the savings being due to decreased storage loss.

520. _____. White Paint Cuts Losses on Petroleum Products Storage. Petrol. Refiner, vol. 31, No. 7, July 1952, pp. 151-153.

Contains essentially the same information as ref. 519.

521. SMYTH, H. D. The Development of Nuclear Power. Chem. Eng. Prog., vol. 50, No. 5, May 1954, pp. 35-36, 50, 54.

Briefly summarizes the United States' nuclear program to date and the problems that lie ahead. Briefly compares investment costs of a nuclear reactor and a steam plant for electrical power production.

522. SNEDDON, RICHARD. Synthesis of Petrochemicals - 6, Successful Acetylene Synthesis........ Petrol. Eng., vol. 26, No. 1, January 1954, pp. C-5-8.

This is the sixth in a series of articles on the synthesis of petrochemicals; the others did not include cost information. This article discusses the Wulff process for producing acetylene from hydrocarbons. Includes investment and operating costs for plants using three different types of hydrocarbon feed.

523. SODAY, F. J. The Role of Petrochemicals in Synthetic Fibers........ Petrol. Refiner, vol. 32, No. 11, November 1953, pp. 114-115.

Briefly summarizes recent growth of the synthetic fiber industry. States that the capital investment required per annual pound of staple fiber product ranges from $1.00 to $1.50, whereas that for continuous filament runs from $2.00 to $2.50. Also estimates the total cost for placing a new fiber on the market.

524. SOMMERS, H. A. The Manufacture and Distribution of Carbon Dioxide. Chem. Eng. Prog., vol. 49, No. 7, July 1953, pp. 333-339.

This article includes the following: (1) A survey of carbon dioxide plants in the United States (location, capacity, CO_2 source, absorbing solution, and approximate cost of product per ton); (2) "discussion of the factors affecting the possible value of sources of raw CO_2"; (3) "brief résumé on production of dry ice"; and (4) description of present transportation methods for solid and liquid CO_2. Gives related investment and operating costs.

525. STANFORD, C. P. Pro & Con: Con: Costs by Kilowatts. Chem. Eng., vol. 60, No. 6, June 1953, p. 160.

This is a letter from C. P. Stanford to the editor expressing disagreement with certain points in Pierce's article on controlling costs by kilowatts (ref. 450). Under the caption entitled "Pro: Costs by Kilowatts" on page 162; immediately following Stanford's letter is D. E. Pierce's reply. He explains how they actually are not in conflict on principles.

526. STEEL, R. A., BOCK, J. A., HERTWIG, W. R., and RUSSUM, L. W. Selecting a Catalytic Reforming Process........ Petrol. Refiner, vol. 33, No. 5, May 1954, pp. 167-171.

Presents an economic comparison and process analysis of the major types of reforming processes. These processes are as follows: (1) A high-pressure process, employing a nonregenerative platinum catalyst; (2) fluid or moving bed process using nonplatinum catalysts; and (3) low-pressure process employing a regenerative platinum catalyst.

527. STEWART, P. B., and KREITH, FRANK. What's Ahead for Jet Engines and Rocket Motors in Process Units? Chem. Eng., vol. 60, No. 9, September 1953, pp. 208-211.

Points out feasible applications of the above types of equipment to the process industries. Includes a table that shows investment and operating costs for several types of vacuum pumps.

528. STORMONT, D. H. Good Citizenship + Good Engineering = Efficient Disposal of Waste Water........ Oil Gas Jour., vol. 52, No. 47, Mar. 29, 1954, pp. 86-87, 112-113.

Describes General Petroleum's waste-disposal system at Torrence, Calif. Gives $200,000 as the investment cost of this plant that daily treats 30,000 barrels of oily water and recovers 175 barrels of oil.

529. STREICHER, L., BOWERS, A. E., and BRIGGS, R. E. Demineralization of Water by Electrolytic and Ion Exchange Processes. Ind. Eng. Chem., vol. 45, No. 11, November 1953, pp. 2394-2401.

Compares the performance and economics of the above two types of demineralization processes with major emphasis placed on the electrolytic process. Includes considerable investment and operating cost data.

530. STUDRABIN, L. P. Cathodic Protection Can Save Chemical Process Equipment. Chem. Eng., vol. 60, No. 5, May 1953, pp. 196-200.

Summarizes the "know-how to date" on the application of cathodic protection to reduce corrosion in thermal process equipment. Gives brief comments on maintenance cost savings actually accomplished by using cathodic protection on two types of installations.

531. SWAIN, PAUL. L.P.G. Storage Booming. Oil Gas Jour., vol. 53, No. 5, June 7, 1954, pp. 66-68, 70.

The article is a survey of underground L.P.G. storage facilities. Estimates this type of storage costs from $0.50 to $2.00 per barrel of capacity, compared to $19.00 per barrel for steel, above-ground storage capacity.

532. TABBERT, T. D. Operating the Gasoline Plant for High Ethane and Propane Recovery........ Oil Gas Jour., vol. 52, No. 18, Sept. 7, 1953, pp. 98, 100, 103, 104-106.

Discusses trends in and operations designed for increased ethane and propane recovery from natural gas. Gives an example of how a pure ethane stream could be recovered with little or no change in operating or fuel expenses. Although some additional investment would be required, the revenue from the increased yield of marketable ethane indicated a rapid payout for this investment.

533. TALLMAN, J. C. Ejectors Show Low First Cost. Chem. Eng., vol. 60, No. 1, January 1953, pp. 176-179.

Discusses design, operation, advantages, and costs of several types of steam-air ejectors. Also see ref. 303.

534. TATOR, KENNETH, KIRKPATRICK, S. D., and CALLAHAM, J. R. How Protective Coatings Fight Corrosion. Chem. Eng., vol. 59, No. 12, December 1952, pp. 143-190.

This constitutes Chemical Engineering's 15th Biennial Report on materials of construction. It is a comprehensive survey of the use of protective coatings to control corrosion. Includes some costs for paint, surface preparation, scaffolding, labor, etc. Also see ref. 362.

535. TEARS, C. F. Catalytic Cycle-Stock Treating Unit........ Oil Gas Jour., vol. 52, No. 6, June 15, 1953, pp. 119, 121-122, 124.

Discusses furfural extraction of cycle feed stocks for increasing catalytically cracked gasoline yields and reducing coke and gas formation during recycle runs. Compares per-barrel-of-capacity investment costs for a catalytic cracking unit with and without associated furfural extraction.

536. _____. Small Refinery Catalytic Cycle Stock Treating........ Petrol. Eng., vol. 25, No. 8, Reference Annual 1953, pp. C-12-14.

Contains essentially the same information as ref. 535.

537. TELKES, MARIA. Fresh Water From Sea Water by Solar Distillation. Ind. Eng. Chem., vol. 45, No. 5, May 1953, pp. 1108-1114.

Discusses several solar distillation units and their operation. Includes costs of distilling fresh water from sea water. Compares solar distillation costs with fuel-operated stills of 1,000-gallon-per-day capacity.

538. TETER, J. W., BORGERSON, B. T., and BECKBERGER, L. H. New Catalytic Reforming Process........ Oil Gas Jour., vol. 52, No. 23, Oct. 12, 1953, pp. 118-121, 140, 144.

Describes Sinclair's reforming process that employs a platinum catalyst. Includes a table of typical operating costs.

539. _____. Sinclair's 'Cat' Reforming Process........ Petrol. Proc., vol. 8, No. 10, October 1953, pp. 1519-1523.

Contains essentially the same information as ref. 538.

540. THOMAS, B. W. Instrumentation. New Sample Preparation Techniques and Trial Program Extend Applications of Spectroscopy. Ind. Eng. Chem., vol. 46, No. 6, June 1954, pp. 85A-86A, 88A.

Describes a new spectral analyzer. Gives cost of such instruments as from $5,800 to $6,400.

541. THOMAS, H. R. Underground Storage........ Oil Gas Jour., vol. 52, No. 4, June 1, 1953, pp. 95-97.

Briefly summarizes the history of underground L.P.G. storage. Discusses the following topics: Storage areas; a hypothetical plant with and without underground storage; underground storage as it affects production and marketing; and advantages of this type of storage. Shows revenue possible for several arrangements of storage facilities with respect to plant and marketing area.

542. THOMPSON, JOSEPH, McGARVEY, F. X., WANTZ, J. F., ALLING, S. F., GILWOOD, M. E., and BABB, D. R. Mixed-Bed Ion Exchange........ Chem. Eng. Prog., vol. 49, No. 8, August 1953, pp. 437-442.

The article constitutes a symposium that covers theory, design of treating units, and results obtained from mixed-bed ion exchange installations.

Graphs compare equipment and chemical costs for 50- and 300-gallon-per-minute-capacity units for both mixed-bed and two-step processes as applicable to 4 geographical areas of the United States.

543. THORNTON, D. P., JR. Underground Storage May Solve Problem of Defense Oil Needs. Petrol. Proc., vol. 8, No. 4, April 1953, p. 454.

Discusses the Edholm underground storage method for petroleum products. Includes investment cost ranges for such storage if the underground caverns already exist or if they must be mined.

544. _____. Accent Was on Premium, How a Small Plant Makes Octanes. Petrol. Proc., vol. 8, No. 8, August 1953, pp. 1159-1161.

Discusses the operation of McBride Refining's 750-barrel-per-day "cat-former" unit. Includes an economic analysis of topping and topping with reforming.

545. _____. After-Filters Remove Way "Haze"........ Petrol. Proc., vol. 8, No. 11, November 1953, pp. 1697-1699.

Describes how Cit-Con solved the wax "haze" problem by installing special cartridge-type after filters. Includes some maintenance cost information.

546. _____. First Complete Udex 'B-T-X' Plant Makes Nitration-Grade Products. Petrol. Proc., vol. 8, No. 3, March 1953, pp. 384-387.

Discusses Cosden Petroleum's platforming-udex installations for producing high-purity aromatics. States that the investment cost was $3,181,000, or 15 percent less than originally estimated. This installation consists of a 4,500-barrel-per-day platformer and a 1,650-barrel-per-day udex unit. Also see refs. 393 and 465.

547. _____. How to Get What You Need When You Order Electric Motors. Petrol. Proc., vol. 8, No. 9, September 1953, pp. 1318-1324.

Gives a very detailed discussion on how to order electric motors. Briefly discusses relative costs of various types of motors and states that for a centrifugal pump motor - "75 hp., 440 volt, 3 phase, 60 c.p.s., 3,600 r.p.m. with normal starting torque (NEMA Design B)" - an explosion-proof motor costs approximately $150 more than a totally enclosed fan-cooled motor, which in turn costs around $600 more than the splash-proof design.

548. TIGHE, F. C. Railroad Rates on Chemicals. Chem. Eng. News, vol. 31, No. 8, Feb. 23, 1953, pp. 752-756.

Discusses the freight rate structure for chemical shipment in the United States.

549. TRAXLER, J. G., and BEAVERS, K. T. Techniques for Cat Unit Turnarounds........ Petrol. Refiner, vol. 32, No. 2, February 1953, pp. 112-114.

Presents details on how to conduct a turnaround on catalytic cracking units, including manpower coordination. Mentions that chemical cleaning saves from $50 to $65 per exchanger over the sandblasting method.

550. TROY, W. N. Models Can Cut Your Piping Costs........ Petrol. Proc., vol. 9, No. 2, February 1954, pp. 224-226.

Describes models that can be made and studied to simplify piping arrangements thus reducing piping costs. Gives advantages and limitations of these models. Estimates that use of these models can reduce piping design costs by as much as 40 percent and 10 percent on piping installation costs.

551. TROYAN, J. E. Properties, Production, and Uses of Hydrazine. Ind. Eng. Chem., vol. 45, No. 12, December 1953, pp. 2608-2612.

Thoroughly reviews the historical development, properties, characteristics, reactions, methods of preparation, and uses of hydrazine. Briefly comments on hydrazine production costs.

552. TYLER, CHAPLIN. Where Cost Estimates Go Sour. Chem. Eng., vol. 60, No. 1, January 1953, pp. 198-200.

The article represents management's appraisal of the estimator's job. Also see refs. 74 and 577.

553. TYSON, C. W., NICHOLSON, E. W., and GORNOWSKI, E. J. Model II Fluid Hydroformer Uses Shot-Catalyst Principle. Oil Gas Jour., vol. 53, No. 2, May 17, 1954, pp. 122, 124-125, 127.

Describes an improved hydroformer unit. Claims for the model II unit from 15 to 20 percent less investment cost and from 7 to 10 cents per barrel of feed less operating cost than for model I.

554. UHL, W. C. Definitely a Big Business, Power From Atoms Still Faces Obstacles. Petrol. Proc., vol. 8, No. 5, May 1953, p. 628.

Briefly summarizes some recent predictions on nuclear power. Includes estimated investment costs for several types of industrial power reactors. Article is a very brief commentary on W. L. Cisler's paper on atomic and electric power, presented at 20th annual meeting, Southeastern Electric Exchange, Boca Raton, Fla., March 23-25, 1953; and J. D. Luntz's paper on atomic energy uses, presented at the manufacturing conference of American Management Association, New York, April 8-10, 1953.

555. _____. Here to Stay, Plastic Piping Has a Two-Fold Interest for Petrochemicals. Petrol. Proc., vol. 8, No. 1, January 1953, p. 12.

Briefly discusses properties and applications of plastic pipe and pipelines. Gives $2.49 per foot as the cost of 2-inch vinyl-vinylidene chloride polymer pipe.

556. _____. A New Energy Source - the Sun - Rises on the Future Horizon. Petrol. Proc., vol. 8, No. 7, July 1953, p. 972.

Discusses the potentialities of solar energy. Estimates that solar heating units for homes will be selling for $2,000 to $3,000 by 1975.

557. _____. Secondary Waste Treating Methods Grow, Although Costs Remain High. Petrol. Proc., vol. 8, No. 4, April 1953, p. 453.

Summarizes a paper on refinery waste disposal presented by R. N. Giles at the 41st annual meeting of the W.P.R.A. in San Antonio, Tex., March 23-25, 1953. Discusses recent trends in treating refinery wastes. States that "An oil-water separator for primary waste treatment costs about $27,000 per million gals. of water treated per day." Secondary treatment - chemical flocculation or biological trickling filtration - "costs over five times as much, around $150,000/million gals./day."

558. UHL, W. C. Shortage Is About Over but Long View for Petrochemical Sulfur Good. Petrol. Proc., vol. 8, No. 6, June 1953, pp. 795-796.

Discusses the current situation regarding sulfur production by the Frasch process. Reports, on the basis of literature information, that sulfur costs from $14 to $16 per ton from a 15-ton-per-day plant that recovers sulfur from refinery gas; from large plants the cost is about $6 per ton.

559. _____. Synthetic Liquid Fuel Industry Still Unlikely for a Good Many Years. Petrol. Proc., vol. 8, No. 3, March 1953, p. 307.

Briefly summarizes the "Final Report of the National Petroleum Council's Committee on Synthetic Liquid Fuels Production Costs, Feb. 26, 1953."

560. _____. Don't Let Heat Go Up Your Flue........ Petrol. Proc., vol. 7, No. 10, October 1952, pp. 1444-1446.

Contains essentially the same cost information as ref. 59.

561. UHL, W. F. Resources for the Chemical Industry in the United States, New England, Power Resources. Ind. Eng. Chem., vol. 44, No. 11, November 1952, pp. 2538-2541.

Discusses power demand, production, and availability in the New England area. Includes comparative costs of purchased power and also power cost as a percentage of total annual manufacturing costs by areas.

562. ULIN, R. P. When Does It Really Pay You to Expand?........ Chem. Eng., vol. 61, No. 4, April 1954, pp. 347-351.

Points out factors that must be considered in planning expansion in light of anticipated changes in the economic picture.

563. UNCLES, R. F., and CARTER, T. L. Watch Those Hidden Packaging Costs........ Chem. Eng., vol. 60, No. 8, August 1953, pp. 185-187.

Gives "some examples of how the wrong choice of container and equipment can multiply your estimates of packaging costs beyond all reason."

564. UPDEGRAFF, NORMAN. From Ammonia to Hydrogen Cyanide........ Petrol. Refiner, vol. 32, No. 9, September 1953, pp. 196-197, 200-201.

Discusses Freeport Sulfur's process for producing hydrogen cyanide from ammonia and hydrocarbons. Includes a summary of investment and operating costs for a plant that will produce 11,500 tons of hydrogen cyanide per year.

565. UPDEGRAFF, N. C., and REYNOLDS, J. C. More Cost Data on the Wulff Process .... Petrol. Refiner, vol. 32, No. 9, September 1953, pp. 162-163, 166-167.

Discusses the Wulff process for producing acetylene from natural gas, propane, etc. Contains both investment and operating costs for this type of processing.

566. VAN FOSSAN, N. E. How to Install Subsurface Storage Facilities for L.P.G. .... Oil Gas Jour., vol. 51, No. 51, Apr. 27, 1953, pp. 192, 194, 197-198.

Discusses the following topics pertaining to underground storage of L.P.G.: Reasons, suitable places, operations involved, and costs.

567. _____. Subsurface Storage of Liquid Hydrocarbons........ Petrol. Eng., vol. 25, No. 1, January 1953, pp. A-53-54, 56, 58.

This article is partly taken from a paper presented at A.S.M.E. conference, Kansas City, Mo., September 1952. Discusses underground storage for L.P.G. The information presented is not the same as that in ref. 566.

568. VAN NOUHUYS, H. C. Comparative Test in High Resistivity Soil of Anodes vs. Rectifiers. Petrol. Eng., vol. 26, No. 5, May 1954, pp. D-56, 58, 60-62, 64-66.

Presents results of tests conducted by Southeastern Pipe Line Co. to determine what type of protection to use to reduce pipeline corrosion.

569. VAUGHAN, H. E. Gasoline and Cycling Plant Economics vs. Increasing Cost of Gas. Petrol. Eng., vol. 25, No. 8, Reference Annual 1953, pp. E-10, 14-16.

Discusses factors that reduce net operating income in natural gasoline and cycling plants. Suggests several ways to reduce expenditures to increase profits. One graph shows a plot of operating revenue versus price of natural gas for both a gasoline plant and a cycling plant.

570. _____. How Rising Cost of Gas Affects Gasoline and Cycling-Plant Economics .... Oil Gas Jour., vol. 52, No. 4, June 1, 1953, pp. 107-108.

Contains essentially the same information as ref. 569.

571. VAUGHAN, T. H. Economics and Commercial Chemical Development. Coordination of Financial and Research Planning. Chem. Eng. News, vol. 31, No. 22, June 1, 1953, pp. 2274-2278.

Discusses coordination of research planning and overall financial planning. Includes hypothetical cases as part of the discussion.

572. VERINK, E. D., JR. Have You Tried Aluminum in Your Refinery?........ Petrol. Refiner, vol. 31, No. 7, July 1952, pp. 141-144.

Discusses the use of aluminum in various types of refinery equipment. States that one refiner claims a yearly maintenance cost savings of $1,000 in a single heat exchanger with aluminum tubes compared to the conventional type. This particular exchanger handles furfural and furfural raffinates in a lube oil plant.

573. VOSS, W. C. Resources for the Chemical Industry in the United States, New England, Construction Requirements. Ind. Eng. Chem., vol. 44, No. 11, November 1952, pp. 2544-2548.

Discusses factors that affect construction requirements. Covers labor rates, labor productivity, and material price trends. Contains the Engineering News Record construction and building cost indexes for 1926 - 50. Also includes the Boeckh index of construction costs for brick, steel, and concrete factories.

574. WALMSLEY, J. G., and WARD, H. A., JR. Troubles and Trends in Use of Mechanical Shaft Seals. Petrol. Refiner, vol. 32, No. 9, September 1953, pp. 203-206.

Discusses costs, design, operation, and maintenance of mechanical shaft seals.

575. WALTER, J. F. A Demonstrated Success.... Statistical Quality Control........ Petrol. Refiner, vol. 33, No. 2, February 1954, pp. 149-152.

Discusses statistical control of product sampling in a continuous fluidized process. States that reducing the number of samples by two per day would mean a savings of about $3,000 per year in laboratory costs.

576. WARE, J. R. Preventive Maintenance of Refinery Compressors........ Oil Gas Jour., vol. 52, No. 37, Jan. 18, 1954, pp. 94, 97-98.

Gives no actual costs but tells how to compare an existing compressor with a new machine from the cost standpoint. Recommends consideration of installation investment distributed over expected life; operating expenses such as labor, fuel, power, etc.; maintenance; etc.

577. WARE, T. M. Pro & Con: Amen on Sour Estimates. Chem. Eng., vol. 60, No. 4, April 1953, p. 156.

This is a letter from T. M. Ware to the editor commenting to some length on Tyler's article on how estimates go sour (ref. 552).

578. WEAVER, J. B. Cost Index to Perry. Chem. Eng., vol. 61, No. 4, April 1954, pp. 381-383.

Gives an index to cost and economic data in the 1950 Edition of Chemical Engineer's Handbook by John H. Perry.

579. WEAVER, THEODORE. Via the Wulff Process, What Acetylene Costs........ Petrol. Refiner, vol. 32, No. 5, May 1953, pp. 151-156.

Discusses the processing involved and goes into considerable detail on the costs of producing acetylene via the Wulff process in the Gulf Coast and Ohio Valley areas.

580. _____. Economics of Acetylene by the Wulff Process. Chem. Eng. Prog., vol. 49, No. 1, January 1953, pp. 35-39.

Contains essentially the same information as ref. 579.

581. **WEBER, GEORGE.** Fluid Coking: New Tool for Old Job........ Oil Gas Jour., vol. 52, No. 15, Aug. 17, 1953, pp. 74-75.

Briefly describes Standard Oil Development's fluid coking process. Gives an investment cost of somewhat over $1 million for a 3,000-barrel-per-day unit to be built at Billings, Mont.

582. _____. Greater Heat Recovery From Catalytic Flue Gas........ Oil Gas Jour., vol. 51, No. 23, Oct. 13, 1952, pp. 346-347, 349.

Contains information similar to that in refs. 59 and 560.

583. _____. Huge Petrochem Plant Dedicated. Oil Gas Jour., vol. 52, No. 29, Nov. 23, 1953, pp. 48-49.

Briefly discusses National Petro-Chemicals' new petrochemical facilities at Tuscola, Ill. Gives $2 million as the investment cost of a sulfuric acid plant that has a yearly capacity of 140,000 tons of 98-percent acid. Gives $7 million as the investment cost of a 50,000-ton-per-year ammonia plant.

584. _____. ....3. Petroleum Coke. Oil Gas Jour., vol. 52, No. 46, March 22, 1954, pp. 151-154.

Discusses production methods and uses for petroleum coke. Includes the statement that "Preliminary tests on fluid coke by a major combustion-equipment manufacturer indicate that it will cost on the order of 50 cents per ton to pulverize fluid coke."

585. _____. New Reforming Process........ Oil Gas Jour., vol. 51, No. 51, Apr. 27, 1953, p. 131.

Briefly discusses Sinclair's new reforming process that employs a platinum catalyst. Estimates the investment cost for a 16,000-barrel-per-day unit as $14 million; catalyst cost from 2 to 10 cents per barrel of reformate; and direct operating cost as 21 cents per barrel of reformate.

586. _____. Quarry Storage for Heating Oils? Oil Gas Jour., vol. 52, No. 9, July 6, 1953, pp. 42-43.

Discusses the potential uses of shale-quarry pits for fuel-oil storage in eastern Pennsylvania. Briefly comments on costs of such storage.

587. WEIL, A. H. Economics of Modern Gas Dehydration. Part 1. Oil Gas Jour., vol. 53, No. 6, June 14, 1954, p. 149. Part 2. Oil Gas Jour., vol. 53, No. 7, June 21, 1954, p. 173; and Part 3. Oil Gas Jour., vol. 53, No. 8, June 28, 1954, p. 127.

Part 1 contains no cost information. Part 2 discusses the pros and cons of low-temperature dehydration equipment. A graph contains curves that show equipment costs for the principal types of dehydration equipment of various capacities. Part 3 discusses operating costs for glycol and solid-desiccant plants for natural-gas dehydration.

588. WEISS, J. M. Petrochem Report; How to Make Phenol....... Oil Gas Jour., vol. 51, No. 42, Feb. 23, 1953, pp. 146, 149, 152, 154-155.

Briefly discusses the four available commercial processes for producing phenol. Covers the subject of production costs from the relative standpoint, not giving actual figures.

589. WERKIN, L. C. Cathodic Protection Licks Corrosion........ Petrol. Refiner, vol. 31, No. 10, October 1952, pp. 122-124.

Discusses cathodic protection and how it can effect savings in refinery corrosion costs. Includes costs for this type protection, as well as comparative costs of replacing corroded equipment.

590. WESSEL, H. E. How to Estimate Costs in a Hurry. Chem. Eng., vol. 60, No. 1, January 1953, pp. 168-171, 200.

Suggests shortcuts for making it easy to evaluate the economics of an operation at the earliest possible stage. Develops the relative significance of each item in the overall picture. Also see ref. 48.

591. _____. New Graph Correlates Operating Labor Data for Chemical Processes. Chem. Eng., vol. 59, No. 7, July 1952, pp. 209-210.

Presents a graph and explains how it can be used to determine man-hours of operating labor required for an operation. It is based on the number of processing steps involved and the plant capacity.

592. WHALEN, J. M. When and Where to Use Air-Cooled Heat Exchangers. Petrol. Proc., vol. 8, No. 10, October 1953, pp. 1528-1531.

Discusses the construction, applications, and advantages of air-cooled heat exchangers. Gives estimated costs for these fluid coolers, as they are called, for a number of petroleum processing applications. Compares the first cost, power cost, maintenance cost, and life expectancy of these coolers with those for cooling towers.

593. WHEAT, J. A. Recovery of 2,3-Butanediol From Fermented Beet Molasses Mashes. Ind. Eng. Chem., vol. 45, No. 11, November 1953, pp. 2387-2394.

Presents a detailed description of the steam-stripping process for recovering "diol" from molasses syrups. Includes a breakdown of initial plant costs, as well as daily production costs.

594. WHEELER, H. P., JR., and ECKARD, W. E. Underground Storage of Natural Gas .... Petrol. Eng., vol. 25, No. 4, April 1953, pp. D-42-43, 45-47, 49-50.

Discusses why and how natural gas is stored underground and the hazards faced when using underground storage in a coal-mining area. Includes the following estimated capital costs for various types of storage:

	Dollars per 1,000 cu. ft.
Sphere (80 p.s.i.)	227.00
Steel pipe (2,240 p.s.i.)	207.00
Gas holder (low pressure)	156.00
Steel pipe (1,560 p.s.i.)	48.00
Natural gas in propane	32.00
Liquefaction	13.00
Salt cavity storage[23]	1.42
Underground storage (water sand)	.53
Underground storage (depleted wells-13 fields)	0.02 - 0.50

595. WIGTON, H. F., and LAUER, B. E. Oil-Shale Retorting through Application of Fluidized-Solids Techniques. Chem. Eng. Prog., vol. 50, No. 3, March 1954, pp. 134-138.

Briefly discusses the nature of oil shale and the principal types of retorts and then describes the design and presents operating data for a fluidized pilot-plant retort. Also summarizes oil-shale mining, crushing, grinding, and retorting costs.

596. WILKINSON, W. F., GHUBLIKIAN, J. R., and OBERGFELL, PAUL. The SO_2 Extraction Process for Aromatics Recovery. Chem. Eng. Prog., vol. 49, No. 5, May 1953, pp. 257-262.

Discusses the Edeleanu sulfur-dioxide extraction process, and a modification of it for recovering aromatics from hydrocarbon mixtures. Includes investment and operating costs for plants employing the modified process.

597. _____. Aromatics by SO_2 Extraction........ Petrol. Eng., vol. 25, No. 8, Reference Annual 1953, pp. C-3-6.

Contains essentially the same information as ref. 596.

598. WILLEY, TOM. Package Pumping for Pipe Lines. Petrol. Eng., vol. 26, No. 5, May 1954, pp. D-40, 42, 44, 46.

Discusses the operation and applications of packaged pumping units. Includes brief summary of operating costs for these units.

599. WILLIAMS, G. C. Pro & Con: Report on Evaporator Costs. Chem. Eng., vol. 60, No. 4, April 1953, p. 156.

This is a letter from G. C. Williams to the editor summarizing the answers received to inquiries on evaporator costs that were sent by the author to equipment manufacturers. Includes a graph with curves that show the relationship between cost and surface area for the following types of evaporators: Film, external tubular heater, calandria, and kettle reboiler (300 p.s.i.).

600. WILLIAMS, ROGER, JR. What to do with That Old Plant?........ Chem. Eng., vol. 60, No. 12, December 1953, pp. 185-186.

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[23] Assuming excavation of 1 million cu. ft. cavity and disposal of salt brine in deep brine strata. Much less if salt is recovered and sold.

Gives some factors to consider, if your plant is "on the borderline of making or losing money." Discusses the questions, "Should you shut down or continue to operate? Should you replace it with a modern plant or a new process?" Includes a breakdown that shows where the sales' dollar goes.

601. WILLIAMSON, G. T. Conserving Natural Gas With Packaged Gasoline Plants........ Petrol. Refiner, vol. 32, No. 4, April 1953, pp. 149-152.

Discusses the applications and advantages of using packaged gasoline plants in certain situations. Includes some investment cost information for these units.

602. WILSON, G. W. What is Good Instrumentation Worth? Petrol. Refiner, vol. 31, No. 12, December 1952, pp. 126-129.

Article explains what good instrumentation is and illustrates the explanation by discussing the instrumentation involved in segregating a high-purity hydrocarbon concentrate by super fractionation. Scattered throughout the article are cost figures that indicate losses owing to poor instrumentation or savings owing to the use of proper instrumentation.

603. WILSON, J. S. Labor and Manpower. Ind. Eng. Chem., vol. 46, No. 3, March 1954, pp. 501-503.

Discusses labor and manpower resources for the East North-Central States. Includes wage and salary rates for Ohio, Indiana, Illinois, Michigan, and Wisconsin.

604. WILSON, W. B. How to Plan Power Distribution........ Chem. Eng., vol. 60, No. 4, April 1953, pp. 199-203.

Presents design and cost data to assist one in planning a reliable, flexible, and economic power-distribution system. Includes installed costs for source units, primary feeder switch gear, and primary feeder cable. Gives approximate costs for electric motors, controls, and substations. See ref. 605 for a companion article that discusses power-generating facilities.

605. _____. Should Your Plant Produce Power? Chem. Eng., vol. 60, No. 3, March 1953, pp. 235-238.

Presents factors to be evaluated in selecting proper electric-power-generating facilities. Gives estimated costs for condensing and noncondensing byproduct power produced by steam-turbine generators. See ref. 604 for a companion article that discusses power-distribution systems.

606. WILSON, W. M. Lion Oil Co.'s Experience With Underground Storage of Butane, Propane, and Gasoline. Oil Gas Jour., vol. 52, No. 43, Mar. 1, 1954, pp. 78-81, 86.

Describes Lion Oil's activities in underground storage of petroleum products and includes investment and maintenance costs for this type of storage. Says installed cost of steel propane storage tanks is $17 per barrel of capacity compared to $1 per barrel of underground-storage capacity.

607. WOOD, J. F. The Training of Analysts. Petrol. Eng., vol. 24, No. 7, July 1952, pp. C-41-42.

Discusses the results to date, of tests made on the N.G.A.A. fractional analysis survey samples; lack of analysts' training is the major contributing factor to variation of results in fractional analysis of natural gas samples. Points out the significance of laboratory errors when they are expanded to a commercial-plant scale involving 60 to 120 million cubic feet of gas per day; these errors can result in poorly designed or operated plants. Gives investment costs for the gathering system and compressors for a natural-gasoline plant handling 60 million cu. ft. of gas daily. Shows yearly revenue loss that would occur from an error of 1 mm. mercury pressure in a 3,000-ml. receiving bottle if used in analysis of gas from the above plant.

608. WOOLFENDEN, L. B., and THIEDE, R. C. Engineering Reference Section. Pumps: Part 17. Designing for Maintenance. Oil Gas Jour., vol. 51, No. 14, Aug. 11, 1952, p. 143.

Presents "some suggested design practices which will insure better and more economical maintenance" of pumps.

609. WORLD OIL. Fuels From Shale May Soon Be Economically Feasible. Vol. 135, No. 6, November 1952, p. 84.

Summarizes R. H. Taylor's talk on fuels from oil-shale that was given before the Texas Mid-Continent Oil & Gas Association at Fort Worth, Tex. Includes a brief summary of investment costs for shale-oil plants.

610. Young, R. M. Performance of Bubble Cap Trays. Petrol. Eng., vol. 26, No. 5, May 1954, pp. C-13-14, 16.

Discusses factors involved in satisfactory bubble-cap tray performance and presents results of research carried out to improve bubble-cap trays. Shows the decrease in size and cost of bubble-cap columns for a specific application from 1948 to 1954.

611. _____. Where Are We Headed on Fractionating-Absorption Tray Design? 1. Bubble Caps........ Oil Gas Jour., vol. 52, No. 51, Apr. 26, 1954, pp. 152-154.

Contains essentially the same information as ref. 610.

612. ZANDONA, O. J., and RIPPIE, C. W. Electrolytic Regeneration of Treating Solutions........ Petrol. Eng., vol. 24, No. 8, Reference Annual 1952, pp. C-11-13, 16.

Describes American Development Corp. electrolytic process for regenerating caustic treating solutions. Includes comparative costs for steam and electrolytic regenerating plants. Also shows the savings in tetraethyllead possible by using electrolytic regeneration method in place of steam regeneration of the spent caustic solutions.

613. ZIMMERMAN, O. T., and LAVINE, IRVIN. Chem. Eng. Costs Quarterly. Part 1. Vol. 2, No. 3, July 1952, pp. 49-76; Part 2. Vol. 2, No. 4, October 1952,

pp. 77-104; Part 3. Vol. 3, No. 1, January 1953, pp. 1-32; Part 4. Vol. 3, No. 2, April 1953, pp. 33-60; Part 5. Vol. 3, No. 3, July 1953, pp. 61-92; Part 6. Vol. 3, No. 4, October 1953, pp. 93-124; Part 7. Vol. 4, No. 1, January 1954, pp. 1-28; and Part 8. Vol. 4, No. 2, April 1954, pp. 29-64.

These references supplement the text Chemical Engineering Costs.[24] These all include a table of current average hourly earnings in the Chemical and Allied Products Industries, as well as current labor and material cost indexes. They show, from time to time, changes in costs of items discussed in previous issues. The major portion of the publication is a detailed compilation of costs for various types of one or more equipment categories; these are mentioned under the individual parts. Part 1, deals with the following: (1) Field-erected-storage-tank costs, compiled by F. L. Plummer, (overall costs and costs for foundations, painting and protective coatings, and fittings and auxiliary equipment); (2) power-plant-equipment costs, including turbo-generators, condensing units, feed heaters, evaporators, and turbines, as compiled by Edwin Durham; (3) Heliflow heat exchanger costs, as compiled by F. Duncan; and (4) Denver adjustable-stroke diaphragm pumps. Part 2 deals with the following: (1) High-vacuum equipment costs, as compiled by G. P. Gerow, (overall costs and costs of pumps, valves, and gages); (2) Haveg equipment, including pipe and fittings, reducers, valves, fume duct, cylindrical tanks, tank covers, plugs and plug outlets, accessories, stuffing boxes, agitators, manholes, rectangular tanks, towers, and pumps; and (3) Entoleter impact mills and aspirator costs, as compiled by R. J. Hoskins. Part 3 deals with the following: (1) Cost literature for 1952; (2) adsorptive dryers; (3) inert-gas generators; (4) Pfaudler glass-lined equipment, including flange pipe, graduated pipe, fittings, valves, reducers, condensers, vacuum receivers, evaporating pans, and crystallizing dishes. Part 4 deals with the following: (1) Shell and tube heat exchanger costs, as compiled by A. M. Michell; (2) Schutte and Koerting steam jet air ejector costs, as compiled by J. H. Peterson; and (3) Brown and Sharpe rotary geared and vane pump costs, as compiled by J. F. Mattimoe and Luther Goff. Part 5 deals with the following: (1) Plate coil heat transfer unit costs, as compiled by F. L. Bridges; (2) propeller-type agitators; (3) mixing tanks; and (4) Stedman packed column costs, as compiled by L. B. Bragg. Part 6 deals with the following: (1) Cast-iron process vessels and auxiliary equipment costs, as compiled by H. P. Voznick, (covers, jackets, thermocoil kettles, agitators and shafts, agitator drives, agitator drive supports, and miscellaneous vessel items); (2) costs of heating and cooling units for molten salt heat-transfer medium as compiled by V. W. Uhl; and (3) Gould stainless-steel centrifugal pump costs, as compiled by G. W. Cramer. Part 7 deals with the following: (1) Chemical plant and equipment ratios for brick building, warehouse, storage tanks, piping, fabrication, instruments, foundation, supports, platforms, building items, sprinklers and fire protection, electrical installations, insulation, painting, engineering, etc., as compiled by Arthur Andros; (2) Hersey reverse-jet dust filter costs, as compiled by K. J. Caplan; and (3) cost literature for 1953. Part 8 deals with the following: (1) Instrument cost estimation as percent of capital investment, as compiled by D. M. Considine and J. J. Kennedy, for the following products or processes: Ammonia, ethylene, fluoride salts, hydrochloric acid, lime, nitric acid, paper, pharmaceuticals, rayon, soap, styrene, sulfuric acid, superphosphate, textiles, gas recovery, hydrofluoric acid alkylation, solvent dewaxing, and thermofor catalytic cracking; and (2) steam-generation costs, as compiled by Edwin Durham. Covers overall costs of steam generation, as well as costs for steam-generation equipment, fuel, labor, maintenance, and depreciation. Also gives costs of equipment items, other than for steam generation, related to electric-power generation.

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[24] Zimmerman, O. T., and Lavine, Irvin. Chemical Engineering Costs. Industrial Research Service, Dover, N. H., 1950, 419 pp.

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